JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

JUNE, 1855.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

Disquisition on the Laws regulating the Slips of Screw Propellers in function of Form and Dimensions; based on a Digest of the Experiments made in 1845 *by M. Bourgeois, Engineer de Vaisseau, at the French Government Manufactory at Indret.* By B. F. Isherwood, Chf. Eng. U. S. Navy.

(Continued from page 304.)

Theoretical Perceptions.

There must be, of course, in the nature of things, sufficient causes for the effects summed up in the previous "*general conclusions;*" let us endeavor to ascertain these causes.

And first, with regard to slip itself. In order that any power may act, it is necessary, in general, that there be an object acted on and an object reacted on. In the case of screws employed for the propulsion of vessels, the vessel is the object acted on, and the water in which it moves is the object reacted on. Action and reaction, or more properly pressure and resistance, are equal and in opposite directions; therefore, whatever pressure is sustained by the vessel and which pressure produces its forward movement, the same is sustained by the water on which the screw acts, which water is the fulcrum of the power as the vessel is the load to be moved. Power is the product of pressure and motion, it is pressure in motion; motionless pressure is in no way power, but wherever there is pressure (or weight) in motion there is power. The same power can only be used once, and if following the exercise of a single power, different masses or weights are put in motion in different directions, they can only have that motion by virtue of a consumption of part of that power, the

aggregates equalling the total power exercised. If the watery fulcrum were perfectly resisting, that is, if it did not yield to the pressure of the screw, all the power applied to the screw (abstraction made of friction) would necessarily be expended in the propulsion of the vessel; but if, owing to the mobility of the water, it yield or recede a certain degree, then a mass of water has been set in motion, and an equivalent amount of the power applied to the screw has been expended in producing that motion. But we have seen that the pressure upon the vessel and upon the watery fulcrum is the same, and as power is the product of the pressure by the velocity, then the velocities of the advance of the vessel and of the recession of the watery fulcrum, measure respectively the powers expended on each. To this recession of the watery fulcrum the name of slip is given, which term expresses the difference between the speed of the screw in the direction of its axis and the speed of the vessel. The speed of the screw is obtained by multiplying its pitch by the number of revolutions made in a given time, the speed of the vessel through the water is obtained by observation; the remainder which is left after subtracting the latter from the former is the slip, and it is always expressed in per centums of the screw's speed. From the facts that the pressure exerted by the screw on the vessel and on the watery fulcrum is the same, and that the vessel and watery fulcrum move with certain velocities in consequence of that pressure, and that power is the product of pressure and speed; it follows, that of the total power developed, abstraction made of friction, portions are expended on the speed of the vessel and on the speed of the watery fulcrum in the ratio of those speeds; but by reason of slip, all the frictions themselves are increased in the ratio of the slip, because it is necessary for the machinery to function either that much longer time or with that much greater speed in equal times, to propel the vessel a given distance; therefore, the loss of useful labor caused by the slip is equal to the slip. That is to say, if the power exercised be 100 and the slip 20 per centums of the screw's speed, then a power of 20 has been uselessly expended. From this brief summary, it will be perceived how important it is for the economical use of power, that the slip be reduced to a minimum. From the foregoing it is also plain, that the slip measures exactly the difference between the resistance of the vessel and of the watery fulcrum; for the same pressure being applied to both, they will move in equal times distances inversely proportional to their resistances—with a slip of 20 per centum, the vessel has gone a distance of 80, while the fulcrum has receded a distance of 20, consequently the resistance of the watery fulcrum in this case is four times the resistance of the vessel.

If the water offered a perfectly resisting or unyielding fulcrum, the whole question would be very simple, the size of the screw would then be quite immaterial in function of any of its dimensions, and all screws, be their form or dimensions what they might, would be equally efficient propellers. But the mobility of water necessitates that a certain quantity of it be simultaneously acted on or pressed by the screw in order to obtain sufficient resistance to serve as a fulcrum to the power; hence, the screw must present an amount of propelling surface in proper relation to the resistance to be overcome, that is, to the vessel to be moved.

And as the slip measures the difference between the resistance of the vessel and the watery fulcrum, it follows, that doubling the screw surface, other things always equal, doubles the resistance of the watery fulcrum, and by consequence, halves its slip or recession. Let us apply this law to the case of otherwise equal screws, but having their diameters in the ratio of 1 and 2, the surface of such screws, being in the ratio of the squares of their diameters, will be as 1 and 4, consequently the screw of double diameter will experience from the watery fulcrum four times the resistance of the other screw, because it embraces or acts on four times the quantity of water, and as the fulcrum presents four times the resistance, its slip will consequently be one-fourth the slip of the other screw, that is to say, if the slip of the screw with the diameter 1, be 20 per centum, the slip of the screw with the diameter 2, will be 5 per centum. And this result, which makes the slip of otherwise equal screws to vary in the ratio of the square of the diameter, is precisely the effect we find to have been ascertained experimentally.

In the case of cutting out the inner portion of the screw blades by the passage of a cylinder whose axis coincides with the axis of the screw, it is plain from the foregoing, that if the resistance of the watery fulcrum, or the slip of the screw, be in proportion to the propelling surface of the screw, other things equal, then the slip with the cut-out screw should be increased in the direct ratio of the surface so cut out, provided the cutting out did not alter the equality of things—but, in the case of cutting out the screw, the comparison cannot be made directly in the ratio of the surface before and after the cutting out, because the part remaining after the cutting out is a ring at a distance from the axis, and the propelling efficiency of surface is, as we have seen, in the ratio of the square of the diameter, that is, in the ratio of the square of its distance from the centre; the slips should therefore be in the ratio of the square roots of the surface before and after the cutting out. Let us apply this deduction to the case of the cut-out screws of Series 2d, Table II, where the cutting out was effected by the passage of a cylinder of coincident axis with the screw and of a diameter equal to half the diameter of the screw. If, now, the diameter of the original screw be taken at 2, and its area represented by 4, the area of the cut-out part whose diameter will be proportionally 1, will be 1 ; consequently, the areas of the screw surface before and after the cutting out will compare as 4 and 3, the square roots of which are as 1·155 and 1·000, and in this ratio the slips should also be:—by referring to the experiments, it will be seen that the actual observed slips were as 1·143 to 1·000, a remarkably close approximation.

Again, with regard to the effect on the slip, by cutting out the inner portion of the blades of the screw by the passage of a cylinder of coincident axis, but of a diameter equal to three-fourths of the diameter of the screw, as with the screw of the 3d Series, Table II. In this case, if we take the diameter of the original screw at 4 and represent its area by 16, the diameter of the cut-out portion will be represented by 3 and its area by 9. The propelling surface of the screw, therefore, before and after the cutting out will compare as 16 to (16—9=) 7, the square roots of which compare as 1·512 to 1·000. By referring to the experiments, the actual slips will be found to compare as 1·408 to 1·000, a very close experimental approximation.

With regard to the effect exerted on the slip of the screw by the length of the pitch, other things being equal; we must consider that as the pitch measures the distance gone by the screw per revolution, it follows, that with a pitch of 1, the screw must make twice the number of revolutions to go a given distance that it would make with a pitch of 2. In both cases, however, the resistance—that is the vessel—would be moved equal distances, and present of course the same resistance. And as the propelling surface would be used with the pitch of 1 twice, where it would be used only once with the pitch of 2, while the resistance or vessel was carried through the same space, it would experience from the watery fulcrum twice the resistance and have one half the slip. In fact, the effect of reducing the pitch of the same screw from 2 to 1, is precisely the same as if two equal screws with pitches of 2 were used, that is, we double by it the resisting surface, and consequently halve the slip. By referring to the numerous experiments, it will be perceived that this result, which makes the slip of otherwise equal screws to be in the direct ratio of their pitches, is there very closely approximated, and the deductions of theory will be found in complete accord with the observations of practice.

With regard to the influence exerted upon the slip by employing less than one convolution of the thread, or by fractioning the pitch; it is plain, that were there no slip at all, every portion of the screw surface would be equally efficient propulsively; but the immediate effect of slip is to set the water pressed by the screw in retreating motion with a certain speed; now from the mode of action of the screw, every portion of the blade from the anterior to the posterior edge presses successively the same molecules of water, and these molecules being set in motion by the portion of the blade at the anterior edge, the succeeding longitudinal portions of the blade receive from the retreating molecules a less resistance, and less by the difference of the squares of the speeds of the blade and of the water. If we imagine that a very narrow strip radially at the anterior edge of the blade first sets a correspondingly small mass of water in motion, it is plain that small mass will rapidly lose its velocity from the smallness of its momentum—the effect of the smallness of its mass—and the succeeding very narrow strip will press it with but little less resistance than the first. We will now imagine these first two very narrow strips to press the water and set it in motion by that pressure, the water thus set in motion being twice the mass of what it was on the first supposition, will have twice the momentum and retain its speed correspondingly longer in virtue of that greater momentum; so that the next succeeding narrow strip of blade will, of course, obtain from it a less resistance than was received by the immediately preceding strip from its predecessor, and so on until the posterior edge of the blade is reached: the mass of water set in motion by the strips of the blade becoming greater and greater as strip after strip is brought into action, and by reason of its increasing mass having greater and greater momentum, it retains by virtue of that increasing momentum the speed imparted to it longer and longer, so that each succeeding narrow strip of blade meets with a continually decreasing resistance from the water on account of its continually increasing speed in the same direction that the blade is moving; so that

when a certain length of blade is employed, it will be found that the rear strips receive scarcely any resistance from the retreating water, which has obtained nearly the velocity of the screw itself. From these considerations it is evident, that the velocity of the water set in motion by the screw increases with accelerated speed from the front to the rear of the blade; the ratio of this acceleration can only be deduced from the different resistances observed with different lengths of blade; it will, of course, be in the same ratio that the experimental slips decrease for increased length of blade.

From these considerations there also follow, that as each doubling of the same screw surface endows the water set in motion by it with twice the momentum, because twice the mass is put in motion with the same velocity;—that the *ratio* of decrease of the slip due to each doubling of the surface, be the absolute amount of surface what it may—will be constant, be the absolute slips what they may; for the *ratio* between the momentums 1 and 2 will evidently always be the same, let their *absolute values* be what they may: and this deduction we find to have been fully confirmed by the experimental results, the ratio of increase of slip by a doubling of the surface being 1·151.

We have thus far considered only the effect of fractioning the pitch by decreasing the length of the blade; but with poly-bladed screws this fractioning can also be effected by the omission of blade after blade; and here we find what could only be discovered by experiment, that the same effect is produced on the slip of the screw by the deduction of equal amounts of surface, whether made in the length of the screw by the passage of a plane perpendicular to the axis preserving the same number of blades, or by the omission of blades preserving the same length of screw. This can only be accounted for on the supposition, that as the blades revolve in the same vertical plane while they advance in a direction at right angles to that plane, their actions interfere, and instead of allowing each to receive from the water the full resistance it would experience were there but one blade in use, it only allows the aggregate resistance obtained by all the blades to equal what it would be with the same surface arranged lengthwise in a fewer number of blades or in a single blade. I cannot, however, trace the reasons that connect by the same ratio of decrease, the slips of the screw by equal reductions of surface, whether made in its length or in the number of its blades. It rests purely on the experimental determination.

The arrangement of the blades of the screw checkerwise, can evidently exert no influence on the slip, in view of the facts contained in the immediately preceding paragraph, because such a disposition of the blades amount to merely a suppression of half their number and a doubling of the length of the screw—preserving throughout the same surface. The result of the direct experiment, was an exact confirmation of the other experiments, showing that the arrangement of the same surface in one or many blades was attended by precisely the same slip.

With regard to the effect exerted on the slip by the curved directrix or expanding pitch, it is necessary to first premise, that by an expanding pitch is understood a pitch which momentarily becomes greater and greater as we pass from the anterior to the posterior edge of the blade. From

this definition there follows, that a screw with an expanding pitch may be considered as composed of an infinite number of screws contiguously arranged on the same axis, and the same in all respects except the pitch, which increases continuously for each fractional screw as we pass from the front to the back end of the axis. We have seen that the slips of otherwise equal screws are in the direct ratio of their pitches, therefore the slip of each of our fractional screws will be in the ratio of their pitches. As each of these fractional screws, proceeding from front to back, have constantly increasing pitches, and as they make revolution for revolution, it is obvious, that they press the water with constantly increasing longitudinal speeds, so that the same water which has been pressed by the initial small pitch and endowed with a slip or velocity of recession proportionable to that pitch, is still vigorously pressed by the succeeding larger pitch with its greater longitudinal speed and slip, and so on to the end of the blade; whereas with the straight directrix the longitudinal speed of the entire screw is uniform, and following portions cannot, as it were, fully *catch up* with and press the water already set in motion by the preceding portions, with any approach to the pressure that the preceding portions exerted on it. The increased efficiency, then, of the curved over the straight directrix, results from the fact, that the longitudinal speed of the screw with the curved directrix continuously increases as we pass from the front to the back, so that the water set in motion by the preceding portions receive from the following portions a greater pressure than they could receive with an otherwise equal screw of straight directrix, whose longitudinal speed for its whole length is uniform. With a screw whose directrix had the curvature of those experimented on, the increased resistance over what would have been obtained with a straight directrix of a pitch equal to the mean pitch of the curved directrix, amounts to six per centum: that is to say, a slip of 30 per centum with the straight directrix would be reduced to 25 per centum with a curved directrix.

An oblique and also a curved generatrix, which is the same as an oblique generatrix whose obliquity is constantly varying, had its origin in the idea that the screw in its rotations endowed with a centrifugal force the water comprised between the blades—that in consequence of being endowed with this centrifugal force this water moved with a certain velocity radially from the axis outward, and that by inclining or curving over the blades, this water could be made to impinge upon them, and thus a certain amount of its power be made to assist in turning the screw and consequently in propelling the vessel. There is nothing, however, in the nature of things to countenance this idea, which is essentially fallacious throughout. The effect of the rotation of the screw, is not at all to give the water comprised between its blades a rotary speed, but to pass that water through with a longitudinal speed in the direction of the axis; a rotary speed and centrifugal force could only be imparted to this water by closing up the front and back of the screw and confining the water between the blades, for as long as the water is not so confined, it will, in consequence of the very rotation of the screw, pass through it longitudinally and be endowed with no centrifugal force whatever; and this effect will be the same, whether the screw be held stationary longitudinally and rotated in the water, or whether it move freely longitudinally

in virtue of that rotation. The experiment with an oblique generatrix fully confirms this deduction, and shows that the effect of such a generatrix on the slip is nothing. A very satisfactory experiment in point was made in England, in 1841, by the Russian General Sabloukoff, on a small screw of 2 feet diameter, composed of one convolution of the thread arranged in two blades. This screw was held stationary, longitudinally, and rotated in the air at a high velocity, and smoke was used to render the phenomena visible, which was, of course, the same as though water had been the medium rotated in. Galloway, an eyewitness, relates the results as follows, viz: 1. The smoke being let on at the anterior or front side of the screw at any point near the periphery, *was drawn towards the screw and carried to the after end.* 2. The smoke being let on at the anterior side of the screw near the hub, *ran along the hub parallel thereto*, and did not appear to acquire *any circular motion.* 3. The smoke being let on at or near the periphery of the screw at its posterior side, was thrown *from* the screw. I have, myself, repeated these experiments on a small screw of about 2 feet diameter, composed of about two-thirds of one convolution of the thread and arranged in six blades. The results were precisely the same; the throwing *from* the screw when the smoke was let on at the posterior side of the screw near the periphery, was in a direction at right angles to the surface of the blades, and not in a radial direction from the axis. At no part was there any indication of a rotary motion having been acquired, and not a vestige of any centrifugal force.

With regard to the influence exerted on the slip by surrounding the blades of the screw with a drum fastened to and moving with them, it is plain, that such an arrangement was based on the same idea of centrifugal force, and that the water displaced by that force in a radial direction from the axis left a vacuum about the centre of the screw. It was, therefore, imagined, that by forcibly holding back this radiating water, it would be kept solid about the axis and give its additional resistance to the central portions of the screw. The direct experiments showed that the band or drum exerted no influence on the slip, which was precisely what might have been expected, for it was only an attempt to obviate an evil which did not exist.

The cause of the trepidations of the screw, or knockings at the stern of the boat, can easily be traced. It results entirely from the want of equilibrium in the pressure on the opposite sides of the shaft exercised by the opposed blades of the screw. There must first be premised, that the resistance of water is in the direct ratio of its depth; a square foot of surface moving in water at a depth of 10 feet will receive twice the resistance it would experience in moving with the same velocity at a depth of 5 feet. Let us take the case of a two bladed screw; these blades in their rotation pass from the upper vertical to the lower vertical position relatively to the axis, and if we suppose the periphery of the blade to just touch the surface of the water when in the upper vertical position, the blade will then have only half the pressure or resistance on it that it will have when in its lower vertical position, and so on relatively when in all other positions except the horizontal, which is the only one where the pressure will be exactly balanced; in all other positions the shaft will be forced towards one side by the unequal pressure of the blades, producing trepidations, the resultant of pressure passing around in the direc-

tion of rotation. If the shaft have some play in the stern bearing, violent knockings will be produced, and in all cases the vessel will have at the stern, whether accompanied or not by trepidations, the strong vibratory or wriggling movement, peculiar to and always observable on screw vessels of even the largest size and strongest build. The slower the vessel goes, the more strongly marked will the trepidations be, because the mass of the machinery will have then less momentum to distribute the inequality among. It is obvious that an increase in the number of blades will more nearly balance the pressure around the axis, and it is found that practically, three blades give but slight trepidations, which wholly disappear with four blades. With one blade, on the contrary, the trepidations are very strong, as might be expected from the totally unbalanced pressure. With two blades there will always be marked trepidations, injurious both to the machinery and vessel. From the same inequality of the resistance of water at different depths, it occurs, that when in a vessel propelled by a screw the machinery is suddenly stopped and the screw in a fixed position is dragged through the water, it will be observed that the vessel will at once deflect from the direction it was pursuing (unless corrected by the helm) in consequence of the unequal resistance offered on the opposite sides of the stern post by the blades of the screw, except in the rare case when the blades happen to be stopped equally arranged on both sides the perpendicular. The wriggling or vibratory movement at the stern of screw vessels is precisely the same and has the same cause, as the movement observed at the stern of a boat sculled by a single oar.

With regard to the effect exerted on the slip of the same screw by its greater or less rotary speed, it is plain, that with the same screw double the rotary velocity will *always* give four times the pressure; for the surface and mode of action of the same screw evidently cannot change by mere change of rotary speed, and double the rotary speed will, of course, give double the longitudinal speed. Now, if the resistance of the vessel increase in the ratio of the square of its velocity, which is sensibly the case with most vessels at speeds within the limits of ordinary practice; then, the resistance of the vessel and of the watery fulcrum pressed by the screw, increase in the same ratio; consequently, the slip of the same screw must remain unchanged, be its rotary velocity and corresponding speed of vessel what they may. If the resistance of the vessel increase in a higher ratio than the square of its speed, then the slip of the same screw will increase proportionally to that higher ratio, and ***vice versa.***

ERRATA.

Page 158, line 18th from top: for "*the slips; again*" read "*the slip again;*"
" 161, " 1st " " " "*fraction of the form*" " "*function of the form.*"
" " " 11th " bottom " "*directly*" " "*directed.*"
" " " 2d " " " "*decreased additional*" " *decreased the additional.*"
" 222, " 9th " " " "*determining*" " "*determined.*"
" 225, " 16th " top " "*of convolution*" " "*of one convolution.*"
" 225, " 5th " bottom " "*comprising*" " "*composing.*"
" 227, In the titles of both tables for "*screw*" read "*screws.*"
" 297, In the heading of the first column of the table, for "*Diameter of the screw*" read "*Designation of the screw.*"

For the Journal of the Franklin Institute.

On the Circumference of the Ellipse. By T. W. Bakewell.

The "Books" contain several Rules for finding the circumference of the ellipse, varying somewhat in detail, but all formed on similar and erroneous premises, and are consequently incorrect in their results.

Two of the given forms are:

Rule A. "$\overline{(\surd_4 D^2+d^2)\times 1{\cdot}11}$" for circumference of $\frac{1}{4}$th the ellipse.

Rule B. "Circumference $\frac{199}{200}p\surd\frac{1}{2}(D^2+d^2)$" for diameter of a circle, equal to that of the ellipse sought.

No rule is accurate that will not bear the test of the two extremes of the ellipse, viz: a circle and a straight line. Rule A, is short in the circle, is nearly correct with axes $\frac{6}{7}$, and is thence in an increasing excess with the eccentricity.

With a line, or ellipse of $\frac{0}{1}$, the correct circumference (perimeter) is 2 —but the rule A gives 2·22, and rule B, 2·2214.

The multiplier 1·11 of rule A, is probably intentionally curtailed from 1·11072, the quotient of $\frac{1}{4}$th of a circle divided by its chord, radius being 1, the latter multiplier giving the *circle* correctly.

Rule B, falls short in the circle, by that part of the formula, "circumference $=\frac{199}{200}p$;" which means $\frac{1}{2}$ per cent. off, uniformly; its nearest approach to truth, is with diameters $\frac{4}{5}$, but is in excess beyond those proportions, in about the same ratio as rule A.

The following rule is exact, the letters referring to the example. Diameters of ellipse d* $\frac{3}{8}$, considered as a vulgar fraction, reduced to a decimal $=\cdot 25b$ make complement for unity $=\cdot 75c$, from which subtract as the axes, viz: $\frac{3}{8}=\cdot 1875s$; the remainder is r ·5625. Multiply the decimal $\cdot 13662t$ by the difference of the axes $=6$, the product is $\cdot 81972v$, which product, multiply by the above remainder $r\cdot 5625=\cdot 4610925h$, to which add mean of axes $=5$, and the sum $5\cdot 4610925f$ is the diameter of a circle of which the circumference is also that of the ellipse.—

$d\,\frac{3}{8}=\cdot 25b$

$\overline{\cdot 75c}$ $\quad \cdot 13662t$

subtract $\frac{3}{8}=\cdot 1875s$ $\quad 6$

$r\cdot 5625 \times \overline{\cdot 81972v} = \cdot 4610925h$

add mean of axes $=5$.

$\overline{5\cdot 4610925f}$

correct,

By Rule A, $\quad 5\cdot 751177$

By Rule B, $\quad 5\cdot 801798$

The constant (in all cases) multiplying decimal † $\cdot 13662t$ of the differences of the axes, is the excess of the required diameter over the mean of the axes in the ellipse (or line) $=\frac{0}{1}$ mean ·5 required excess for circumference or perimeter of 2. $\frac{\cdot 13662}{\cdot 63662}$.

* This (d) and the following, are letters of reference only.—Com. Pub.

†More accurately ·1366197697+

The subjoined Rule on the same principle as the above, may be more easily understood.

The example will explain itself:—

Ellipse $\frac{3}{8}$ diff. $6 \times \cdot 13662$

$\cdot 81972$

Subtract as axes $\frac{3}{8} = \cdot 20493$

$\cdot 61479$

Subtract again from remainder $\frac{3}{8} = \cdot 1536975$

$\cdot 4610925$

Add mean of axes $5 \cdot$

Diameter for circumference of circle and ellipse, $5 \cdot 4610925$

Cincinnati, April, 1855.

AMERICAN PATENTS.

List of American Patents which issued from April 10, *to April* 24, 1855, *(inclusive,) with Exemplifications.*

APRIL 10.

49. For an *Improved Lathe;* Warren Aldrich, Lowell, Massachusetts.

Claim.—"I herein claim a combination, (when used in connexion with a tool rest or carriage, a rotary carriage, and a sliding carriage, disclaimed,) consisting of a long screw, *b*, a vertical shaft, two worm geers, and a screw, *n*, arranged, applied, and made to operate together."

50. For an *Improvement in Drills for Artesian Wells;* J. Andrews, Winchester, Mass.

Claim.—"The use of a stiff chain, for the purpose of operating a rock drill, or other artesian borer. Also, the device for rotating the drill, consisting essentially of the cog wheel and pinion, with the parts which set them in motion."

51. For *Saw Teeth;* Nelson Barlow, Newark, New Jersey.

Claim.—"The improvements, consisting of the recessed space and combined cutters upon the sides of saw teeth, and also the rounded form given to the outer points of the teeth."

52. For an *Improvement in Steam Boilers;* Horace Boardman, Plattsburg, N. H.

Claim.—"1st, The graduating of the openings in the flues or tubes. Also, in connexion with the flues or tubes, the semi-division flue plates in the chamber, for regulating and equalizing the egress of the heated products through said tubes. Also, the inclination of the tubes and tube sheets, for the double purpose of preserving a space between the tube for the sediment to collect in, and from which it can be readily removed, and for preserving a square surface between the tops of the tubes and said sheets, so that they can be fairly riveted."

53. For an *Improved Machine for Raising and Transporting Stone;* Solomon E. Bolles, Rochester, Massachusetts.

Claim.—"The construction of an axletree for a 'stone digger,' in combination with the bed frame and derrick."

54. For an *Improvement in Rotary Harrows;* L. Brainard and L. Newton, Ithaca, N. Y.

Claim.—"The employment of the wheel-shaped harrow, when fastened upon a central point, so as to turn in either direction."

55. For an *Improvement in Machinery for Winding up Lines, Twist, or Cord;* Byron Boardman and George C. Sweett, Norwich, Connecticut.

Claim.—"1st, The sweep, composed of an arm attached to a hollow shaft, and carrying a hollow tube, which is caused, by the revolution of the shaft, to lay round the fixed hooks a line, cord, twist, or other fabric of similar character, which is conducted through the shaft and the said tube. 2d, So arranging, applying, and operating the sweep and the hooks around which it lays the line or other fabric, that the hooks shall remain stationary in a suitable position to receive the line or fabric while the sweep revolves around them, and that the hooks, after the operation of the sweep terminates, shall rotate upon axes in line with each other, to perform the woolding. 3d, Giving the tube of the sweep a motion endwise, simultaneously with its revolution, by any means, for the purpose of laying the line or fabric evenly on the hooks, and preventing its being laid in heaps. 4th, The manner of disengaging the pulley, or its equivalent, which drives the sweep shaft, in order to stop the sweep at the proper time, and in the proper position, by means of the sliding piece, the lever, and the adjustable pin in the ratchet wheel, or its equivalent, deriving motion from the sweep shaft. 5th, The rod, arranged and operating for either or both of the purposes herein set forth, viz: 1st, To carry a clasp which regulates the woolding; and 2d, To carry fins, pins, or other projections, to operate a catch, or its equivalent, to cause the engagement and disengagement of the gearing which gives revolution to the hooks to perform the woolding. 6th, The application to the clasp of a catch lever, to hold the jaws open during the laying operation, and to be caused to liberate them by the falling of the clasp, to allow them to close ready for the woolding operation."

56. For an *Improved Arrangement of Dies and Stocks for Ornamenting Metal Tubes;* Stephen M. Cate and Edmund Jordan, Waterbury, Connecticut.

Claim.—"The combination of the adjustable die stocks with the revolving dies, in a self-feeding machine for ornamenting tubes, &c."

57. For an *Improvement in Boot Forms;* John Chilcot and R. Snell, Brooklyn, N. Y.

Claim.—"1st, The inner clamp fitted to a recess in the front piece, so that its exterior presents the desired surface for a part of the front piece, whereby, after having held the first edge of the front seam of the leg seam to the front piece, till the whole piece of material is lapped to the proper form, it may be drawn out lengthwise and re-inserted in the front piece, inside the edge it previously held, and thus throw out the said edge and part of the material immediately behind it, into contact with that part of the material which overlaps, and is to be united to it to make the seam. 2d, The exterior clamps attached to screws, working in an upright, which is attached to the front piece in a suitable position for the clamps to hold the two parts of the front seam together, and to allow the said front piece to be taken from the upper."

58. For an *Improvement in Recording Votes in Legislative Bodies;* Thomas C. Connolly, Washington, District of Columbia.

Claim.—"The moving of the slides containing the members' names, into columns of yeas and nays; this arrangement being one that is well calculated for the convenient display of the vote to all the members of the body voting. Also, the arranging of a series of types, stereotype, or plates, in a galley, by a system of levers, cords, wires, &c., extending from each desk or seat to said galley, so that any number of impressions of the exact record of the vote taken, may be instantly printed or struck off. Also, the so arranging in a galley of a series of types, stereotype, or plates, as that they may be readily moved therein to the left or right, and instantly locked into form, from which printed impressions may be taken by any of the well known means."

59. For an *Improvement in Seed Planters;* Jason W. Corey, Crawfordsville, Indiana.

Claim.—"The adjustable seed or slide box. Also, the arrangement of adjustable slide, adjustable seed gauge, coiled spring, and connecting rod, together with grooved roller, slotted arms, front share, adjustable clod mover, and covering shares."

60. For an *Improvement in Locomotive Boilers;* Josiah J. Dutcher, New Haven, Conn.

Claim.—"1st, The arrangement of water spaces within and contiguous to the furnace, and leading therefrom to the body of the boiler, consisting of the horizontal pipe, inverted cone, upright tube, and horizontal tube. 2d, In combination with a hinged fire grate

or grates, to the boiler furnace, I claim providing hinged traps in the ash pan, to be lowered and raised or opened and closed simultaneously with the fire grate or grates, by means of an upright rod passing through the boiler, and suspended from a lever within the control of the engineer or fireman, while at his usual post, the said rod operating upon the said grates and traps, by means of arms, or their equivalents. 3d, Retarding the escape, down the inclined ash pan, of the ashes, coal, &c., falling thereon through the grate, by means of curb plates, arranged to make the said ashes, coal, &c., take a circuitous direction."

61. For a *Card Exhibitor;* Wright Duryea, City of New York.

Claim.—"The improvement in card exhibitors and distributors, consisting in the application of the roller, printed strip, guide, and self-closing spring holder."

62. For an *Improvement in Portable Door Fasteners;* Benjamin R. Eames, South Newry, Maine.

Claim.—"The combination of bifurcated hooked bar, spring, compensator, and horizontally moving brace; the compensator and brace movable about the vertical connexion of said bar, whereby the self-movement of the brace is prevented, while it performs the double function of gauge and brace."

63. For an *Improvement in Framing for Building Concrete Walls;* Salathiel Ellis, City of New York.

Claim.—"The construction of the clamps, so that they can be moved or turned up, as necessity requires, and the combination of these clamps with the rods and boards to form a self-supporting frame."

64. For a *Tool for Boring Hubs;* Henry C. Garvin and J. H. King, Hagerstown, Md.

Claim.—"The apparatus for boring wagon and carriage hubs for reception of boxes, (narrow and through boxes,) using for that purpose the aforesaid apparatus, or any other substantially the same."

65. For an *Improvement in Furnaces for Burning Wet Fuel;* Moses Thompson, Henrico County, Virginia.

Claim.—"The combination, for the purposes of a high degree of heat, of bogasse, refuse tan, saw dust, and other refuse substances, or very wet and green wood, by the employment of a series of fire chambers, arranged in any manner, to communicate with one flue, when any number of the said chambers are nearly closed to the flue, and to the admission of air, when first charged, while the remaining chamber or chambers are in free communication with the flue, and has a free supply of air admitted, and each chamber in its turn is nearly closed and then opened, and has air admitted, whereby the heat required is furnished by the combustion of the fuel in one or more chambers, while the fuel in the other chamber or chambers is being heated and decomposed to a desirable degree, no artificial blast being used."

66. For a *Mode of Guiding Reciprocating Saws;* C. B. Hutchinson, Auburn, N. Y.

Claim.—"In the mode of hanging saws for saw mills, the use of a thin guide plate for holding and guiding the saw placed immediately behind and in the same plane with it, and following it through the log, whether the same be used by itself, or in connexion with any other means of holding and guiding the saw."

67. For an *Improvement in Railroad Car Coupling;* James H. Jones, Scio, N. Y.

Claim.—"A car coupling without a link, which may be a permanent fixture on the car, and each half so formed as that the jaws or hooks will always couple or catch, the one with the other, when brought together, regardless of the particular ends of the cars which may be brought together."

68. For an *Improvement in Fire Arms;* Ferdinand Klein, Newark, New Jersey.

Claim.—"An improvement in the manner of opening and closing the valve or cover of the chamber which receives the charge. Also, the use of a cap, for the purpose of protecting the chamber and the spring that moves it."

69. For an *Improvement in Steam Generators;* Alex. B. Latta, Cincinnati, Ohio.

Claim.—"1st, Combining a steam generator or boiler, consisting of a coil of tube with a furnace, in such a manner that the flame or products of combustion shall come

in immediate contact with said coil, when this coil is combined with a feed apparatus and gauges, which will enable the engineer to inspect constantly the supply of water, see that it is not interrupted, test its sufficiency, and regulate it at pleasure, according to the varying demands of the boiler, or close the dampers if the feed should be interrupted. Also, while confining the admission of water to the receiving end of a coiled tube boiler, limiting the quantity therein, and the supply thereof, to the quantity demanded for immediate conversion into steam, for the purpose of avoiding the weight of a large quantity of water, for producing steam promptly, saving fuel, and preventing the water from being thrown out of the tube by the steam formed in the lower part thereof. Also, causing the discharging end of a coiled tube generator to communicate with and discharge itself into the water jacket, while all other communication of said coil with said water jacket is avoided."

70. For an *Improvement in Straw Cutters;* Walter Lackey, Worcester, Mass.

Claim.—"The use of the heads, when made to correspond with the flanch or flanches, to facilitate the setting of them, and prevent their striking over the stationary knife or bed. Also, the flanches, in combination with the heads working against the stationary knife. Also, the combination of the flanches, heads, stationary knife, and feed rolls, or any other substantially the same."

71. For a *Spiral Wheel for Replacing Railroad Cars upon the Track;* Robert F. R. Lewis, Annapolis, Maryland.

Claim.—"The application of one or more cast or wrought iron hollow cylinders, wormed, flanched, or screw threaded on their exterior surfaces, in the manner of a plain screw to rail trucks or carriages, in place of, or in combination with the common or ordinary flanch wheel, and thereby prevent the same from running off, or being thrown from the track whilst in forward motion."

72. For an *Improvement in Graduating the Tension of Car Brakes;* W. Loughridge, Weverton, Maryland.

Claim.—"The combination and arrangement of the sliding plate, having a series of holes graduated for limiting its play by an adjustable pin, the supplementary chain, wound upon the chain barrel, which receives the chain for actuating the brakes, the lever for bringing the said barrel into and out of action, the spring catch for holding the said lever in engagement until tripped by the pin of the aforesaid sliding plate, when the lever is released and the power is maintained without any further increase; the whole constituting an automatic disengaging apparatus, capable of being graduated so as to apply and retain any degree of frictional pressure that may be previously desired, by the simple adjustment of the movable pin in the sliding plate."

73. For a *Stationary Hydro-Pneumatic Engine for Extinguishing Fires;* William Loughridge, Weverton, Maryland.

Claim.—"1st, The employment, for the purpose of supplying water for fires and ordinary uses at the same time, of the supply and force pipes connected, by connecting pipes fitted with valves, said supply pipe being connected with the suction, and said force pipe with the discharge of a force pump. 2d, The application of the weight, or its equivalent, to the driving shaft of the pump, in connexion with a brake, for the purpose of setting the said shaft in motion by the mere act of liberating it from the restraint of the brake, and thereby calling the attention of the engineer, and continuing to drive it until the engineer can get the engine ready and connect it, thereby obviating the necessity of having the engine always connected and in readiness. 3d, The combination of the signal pipe, the tank and float, the signal pipe being connected either with the supply or force pipe, and the float with the brake lever, for the purpose of enabling a person at any distance from the forcing pump to set free the brake and start the pump instantaneously, and to give notice to the engineer when to connect the engine, or get it in readiness."

74. For an *Improved Machinery for Boring Wells;* John F. Manahan, Lowell, Mass.

Claim.—"The boring cylinder, having a cutter at its lower end, and an adjustable cutter in its periphery for enlarging the hole so that the auger cannot bind when in use, and so that the tube designed to line the well can follow the auger or cylinder downwards, and allow this auger to be drawn up through the lining tube, by the shutting or moving of the enlarging cutter. Also, the metallic chain of buckets, in combination

with the earth cutter, operating or moving in such manner within it as to receive the earth as fast as it is cut from the ground, and elevate it to the desired height."

75. For an *Improvement in Machines for Paring Apples;* Samuel N. Maxam, Shelburne Falls, Massachusetts.

Claim.—"The inclined plane scroll, combined with the movers, or their mechanical equivalents."

76. For an *Improvement in Cultivators;* A. H. Morrel, Marlen, Texas.

Claim.—"1st, The combination of the adjustable thinning point or points, at the forward end of the cultivator, with the adjustable cultivating point or points at the rear end of the cultivator. Also, combining the rotating cutter with the laterally adjustable thinning point or points, and the cultivating point or points."

77. For a *Machine for Mortising Blinds;* Benjamin J. Norris, Lynn, Mass.

Claim.—"The manner of constructing and operating the hollow pulley and spindle, together with the levers attached. Also, the manner of operating and guiding the stock, by the combination of the lever with the racks and the movable detents."

78. For an *Improved Gas Regulator;* Samuel P. Parham, Trenton, New Jersey.

Claim.—"A conical valve, or its equivalent, operated by a jet of air, gas, or water applied immediately under it, or against a cup or valve connected to it, in combination with an elliptical seat, or its equivalent, so constructed as to let the requisite supply of air, gas, or water escape when the valve is forced into the seat, the whole being so constructed and arranged as to regulate and equalize the flow of air, gas, or water, and furnish a uniform or nearly uniform supply under different degrees of pressure."

79. For an *Improvement in Bedstead Fastenings;* Joseph Rodefer, Cincinnati, Ohio.

Claim.—"The circular split ring let into a segmental annular mortise in the rail, from which its upper end projects in the form of a hook, and its lower end in form as described, permitting the passage of the catch pin in the act of insertion, affording an additional lateral bearing and a means of adjustment."

80. For an *Improvement in Straw Cutters;* Ira Rose, Akron, Ohio.

Claim.—"The combination of the cam, yoke, and lever, with the rock shaft and pawls."

81. For *Improved Venetian Window Blinds;* Charles Rose, Allentown, Pennsylvania.

Claim.—"In combination with the lower head and blind, the additional or upper head, and the hooks and cords, for readily connecting or disconnecting the two heads, for the purpose of placing or removing the blind from the window."

82. For an *Improvement in Straw Cutters;* David Russell, Drewersburgh, Indiana.

Claim.—"1st, The knives, in combination with the double crank and lever, thereby giving to the knives an oscillating reciprocating motion, by which means I obtain two shear cuts of the knives at each revolution of the double crank. 2d, The cam lever and crank, in combination with the levers and pawls, ratchet and feed rollers, for the purpose of feeding the straw or other material to the knives."

83. For an *Improvement in Straw Cutters;* Samuel J. Sharp, Danville, Missouri.

Claim.—"The arranging a circular knife and a circular guard upon a common pivot, so that they will revolve one towards the other until they meet, each traveling the same distance, or the arranging two knives, circular, upon a common pivot, so that they will revolve towards each other until they meet."

84. For an *Improvement in Platform Balances;* David M. Smyth, City of New York.

Claim.—"The arrangement of the platform, with hangers suspended at four corners to the two rockers, which are linked together, when this is combined with the weighted arms on the rockers, operating on the principle of the bent lever."

85. For an *Improvement in Straw Cutters;* Thos. C. Simonton and Loren J. Wicks, Paterson, New Jersey.

Claim.—"The combination of the cylinder with the knives attached to its periphery, and vibrating bed."

86. For a *Plate Holder for Cameras;* Albert S. Southworth, Boston, Mass.

Claim.—"The plate holder, in combination with the frame in which it moves."

87. For an *Improvement in Adjustable Friction Rollers;* John and Thomas Sweeney, Birmingham, Pennsylvania.

Claim.—"The use of sliding boxes to carry the journals of the friction rollers, in combination with the springs, for the purpose of pressing them all continually against the surface of the journal or gudgeon of the shaft, which works in the rollers so as to make them all revolve as the journal revolves, not only on their own axes, but around the journal."

88. For an *Apparatus for Feeding Paper to Printing Presses;* J. B. Hall, City of N. Y.

Claim.—"1st, Lifting or picking up the sheets of paper from the feed boards or piles of paper to be printed, by means of nippers, pincers, or tweezers, operated by any suitable mechanism, so that the jaws of said nippers may, when slightly open, press upon the sheets of paper in such a manner that when closing, they may grasp or nip the upper surface of the top sheet, or the ridge of the sheet formed between them by their pressure. 2d, Separating or detaching the uppermost sheet of paper on the feed board or pile of paper to be printed, so as to prevent the removal therefrom of more than a single sheet at a time, by means of the hooks, or by pins or points, so constructed and operated as to answer the same purpose, and rollers attached to a shaft or other suitable fixtures, and in connexion with said hooks and rollers, by means of a reciprocating motion of the platform, feed board, and pile of paper; the said hooks, pins, or points acting conjointly with the said movable platform. 3d, Conveying the raised sheets of paper from the feed boards to the form to be printed, and also from the form when printed, to the proper boxes or receptacles, by means of the fingers attached to the tube and shaft, which is secured to endless bands or cords, which are pinned with collars or teeth to prevent them slipping in passing around suitable pulleys, or by means of other fixtures which would be equivalent to the above named parts, when they are used in connexion with a vibrating or movable frame, or its equivalent, for properly adjusting the printed sheets in the boxes or receptacles when released from the fingers."

89. For an *Improvement in Cabin Chairs;* William Thomas, Hingham, Mass.

Claim.—"Placing the seat within a frame which is attached by pivots to the body of the chair, the seat having friction rollers or wheels attached to its under side, which work upon the lower curved portion of the frame, whereby the frame and body of the chair are allowed to turn or be inclined in accordance with the motions of the vessel, and the seat at the same time always remaining in a horizontal position."

90. For an *Improvement in Wooden Splice-Piece for Railways;* Isaac R. Trimble, Baltimore, Maryland; dated April 10th, 1855; ante-dated October 10th, 1854.

Claim.—"The combination of a wooden splice-piece strong enough to resist the lateral and vertical disturbances to which the adjacent ends of rails are liable, in combination with any form of rail competent to its purpose, without other support throughout than its own stiffness, the said splice-piece and rail in the combination now claimed, being fastened together and fastened down."

91. For a *Device for Allowing Circular Saw Spindles to Yield;* Hiram Wells, Florence, Massachusetts.

Claim.—"Arranging within the box or bearing, and combining with it and the saw spindle, the guide, its spring, and the compound frustra conical grooves provided with shoulders, the whole constituting a device of great simplicity of construction, and of much advantage in not only allowing a circular saw, while in operation, to move laterally, but to limit such movement of it, and subsequently restore it to its normal or original position."

92. For an *Improved Implement for Boring the Earth;* C. N. White, Concord, N. C.

Claim.—"The combination of the frame and weight, with the movable inclined rods attached."

93. For an *Improved Paint Mill;* David E. Paynter, Assignor to Israel M. Bissell, Philadelphia, Pennsylvania.

Claim.—"The arrangement and combination of the double cone with the barrel."

94. For an *Improvement in Lathes for Turning Locomotive Drivers;* J. M. Stone, Manchester, New Hampshire, Assignor to Manchester Locomotive Works.

Claim.—"The drills, in combination with the turning lathe, the one being mortised through the face plate, the other through the foot stock."

APRIL 17.

95. For an *Improvement in Bleaching Apparatus;* C. F. Appleton, Roxbury, Mass.

Claim.—"The combination of an air-tight vat for receiving and retaining the goods, an apparatus for exhausting the air therefrom, and the necessary vessel containing the liquids used in the process of bleaching, whereby the various steps may be performed in a much shorter space of time than has heretefore been required, and without removing the goods from the vat."

96. For an *Improvement in Sash Fasteners;* Wm. E. Arnold, Rochester, New York.

Claim.—"The mode of constructing and arranging a slide bolt and case so as at pleasure to form either a right or left hand lock."

97. For an *Improvement in the Construction of Gas Retorts;* H. P. M. Birkinbine, Philadelphia, Pennsylvania.

Claim.—"The gas retort with the annular space above, cast with and making a part of it."

98. For an *Improvement in Machines for Punching Metal;* Marshall Burnett and Chas. Vander Wœrd, Boston, Massachusetts.

Claim.—"So combining the punching bar with a vibrating lever at one end, and a cam at the other of it, as that it shall always rise and fall in a plane parallel to the bed of the machine."

99. For an *Improvement in Melodeons;* Jeremiah Carhart, City of New York.

Claim.—"The arrangement, in instruments operated by the exhaustion of air, of the reeds, valves, and hammers, in relation to the exhausting bellows or passage, so that the hammer is caused to operate outside of the influence of the bellows, and not between the bellows and the reed, and whereby the hammer may be readily detached and taken out of the instrument for repair, tuning, or adjustment of the reed without destroying the capability of the reed to speak or play. Without claiming the application of buffs, consisting of strips of leather, to musical instruments generally, or for any other purpose than that which I have specified, I claim their application to reed instruments, in connexion with the hammers."

100. For an *Improvement in Grain and Grass Harvesters;* J. Case, Springfield, Ohio.

Claim.—"Placing the line shaft directly above the vertical centre of the spur gear of the master wheel. Also, the adjustable anti-friction wheel, in combination with the spring and adjustable set screws."

101. For an *Improvement in Explosive Gas Engines;* Alfred Drake, Philadelphia, Pa.

Claim.—"1st, The igniting apparatus, composed of the thimble and the interior tube or blow pipe. 2d, The arrangement and combination of the hollow piston rod, piston, and jacket surrounding the cylinder, for the purpose of maintaining a constant circulation of water for cooling."

102. For an *Improvement in Lubricating Compounds;* N. Dresser, Rochester, N. Y.

Claim.—"The lubricating compound, and its application to journals, cranks, axles, and other machinery subject to friction."

103. For an *Improvement in Putting a Gas Generator in a Parlor Stove;* Solomon B. Ellithorp, Elmira, New York.

Claim.—"The combination of the coal stove and retort, making a portable coal gas generator."

104. For an *Improvement in Ship's Windlass;* James Emerson, Worcester, Mass.

Claim.—"The combination of the geared sectors with pawls attached, and the part with pinions, levers, and pulleys."

105. For an *Improvement in Processes for Melting Sugar;* Conrad William Finzel, Bristol, England; patented in England, May 7, 1853.

Claim.—"Melting the raw sugar in a vacuum, preparatory to the further refining thereof."

106. For an *Improvement in Dredging Machines;* Charles H. Fondé, Mobile, Ala.

Claim.—"The device for keeping the wheel in gear while raising and lowering, and the combination of the radius bar and the sliding carriage which carries the shafts of the pinion, and also moves the water wheels which slide on the feathered shafts, as this device and this combination of well-known mechanical devices is my own invention, and has enabled me to keep the excavating wheel always in gear with the engine, and has never been so applied before. Also, the self-acting latch in its particular form and mode of adjustment, it being so shaped and adjusted as to hold on to the lid of the bucket until it is struck by the tipper, and so balanced that by its own gravity it will fall over and latch again before the bucket enters the water; this particular form and adjustment, with the pin, does away with the necessity of springs, and is the result of careful and expensive experiments. Also, that particular combination of chutes or slice-ways which form an apex under the discharging tipper, and pass athwartships on an incline towards the screws, which particular combination has enabled me to discharge an excavating wheel laterally on either or both sides."

107. For an *Improvement in Grain and Grass Harvesters;* Eliakim B. Forbush, Buffalo, New York.

Claim.—"1st, The combination of the gear key with the gearing. 2d, The extension of the platform timber beyond the finger bar, so as to connect it to the main frame of the machine near the driving wheel, with the view of giving strength and stiffness to the platform, and bring its weight as much as possible on the main frame near the driving wheel. 3d, The locks, as improvements upon the clamp. 4th, The improvement of the second angle in the brace bar of the guard finger."

108. For an *Improvement in Moulds for Casting Pencil Sharpeners;* W. K. Foster, Bangor, Maine.

Claim.—"The arrangement of the spring holder and sliding plates, in relation to the grooved core and gauge, for the purpose of the adjusting and holding of the blade in the mould, and the forming of the slat in the pencil sharpeners."

109. For an *Improvement in Machines for Punching Metal;* DeGrasse Fowler and George Fowler, Wallingford, Connecticut.

Claim.—"The peculiar method of connecting the operation of the two levers to throw the machine out of gear at the time when the punch is at its greatest elevation."

110. For an *Improved Apparatus for Turning the Leaves of Music Books;* Isaac Gallup, Mystic Bridge, Connecticut.

Claim.—"1st, The employment and arrangement of the swinging bars and keys, in combination with said revolving self-adjusting pulleys or finger carriers. 2d, The employment of the spring I, in combination with the spring H. 3d, Providing a stop on each of the keys, and a spring catch on the under side of the top of the case, to fit against said stop. 4th, Providing each of the fingers with an extension."

111. For an *Improved Stud and Button Fastening;* Samuel W. Hopkins, Assignor to William C. Greene, John T. Mauran, and Charles Jackson, Providence, R. I.

Claim.—"The construction of the fastening, viz: having the shank of the stud or button formed of a tube which contains a spiral spring, and having a bar fitted in slots in the outer end of said tube and between the outer end of the spiral spring and a pin attached to the outer end of the tube; the outer side of the bar being provided with a recess, which, by means of the spring, is kept over the pin, and the bar consequently secured in a transversed position with the tube."

112. For an *Improvement in Rotary Engines;* Abraham Masson, Philadelphia, Pa.

Claim.—"The combination of the four steam cylinders and pistons with the curved guide, arranged and operating so as to produce a continuous rotary motion."

113. For an *Improved Fountain Pen;* Hugh K. McClelland, Eldersville, Pa.

Claim.—"The construction of the implement, viz: having a bag or receptacle placed

within a tubular handle, the lower end of said bag having a tube attached to it, which tube is provided with a valve and button or spur, the tube, valve, and button or spur being inclosed by the pen holder, which contains a sponge, and is provided with openings or channels through which the pen is supplied with ink as the valve is operated."

114. For a *Hay Making Machine;* Francis Peabody, Salem, Massachusetts.

Claim.—"1st, The machine for making hay, consisting essentially of the rake for gathering the grass, in combination with the revolving scatterer. 2d, Revolving the scatterer in a direction contrary to that in which the machine moves. 3d, The employment of a single wheel to carry and actuate the hay makers, when this wheel is placed in the centre of the machine."

115. For an *Improvement in Shut-off Valve Gear;* John B. Schenck, Ansonia, Conn.

Claim.—"1st, Connecting the slide valve with a lever, which is also connected at different points with two arms of unequal length, working side by side, and receiving motion from separate cams on the crank shaft of the engine, or some other shaft having a corresponding motion therewith, the whole operating to give the valve a double movement. 2d, Effecting the connexion between the finger wheel and the bevel wheel, or its equivalents, through which the said finger wheel transmits the movements of the governor to the cut-off cam, by means of pawls acting upon ratchet teeth, and providing a stud or stop on the opposite cam to that which carries the finger wheel for the purpose, when the cut-off cam arrives in position to give full steam for the whole stroke of the piston, of liberating the pawl, by which the motion is transmitted in the direction for retarding the operation of the cut-off cam, and thereby rendering it inoperative."

116. For an *Improvement in Horse Powers;* John Simpson, Atlanta, Georgia.

Claim.—"1st, The employment of the large or main vertical driving wheel without central bearings, in combination with the suspension band. 2d, In combination with the driving wheel without central bearings, and the suspension band, the inner run and the pulley, so arranged as to throw the foot of the driving wheel back."

117. For *Compensating Bearings;* Lewis Smith, Buffalo, New York.

Claim.—"Relieving bearings of machinery from undue pressure and consequent friction, by means of the different expansion of two or more different metals."

118. For an *Improvement in Making Printers' Ink;* C. A. Thompson, Adrian, Mich.

Claim.—"The composition of oil varnish, to be mixed with rosin, soap, lampblack, &c., for printers' ink."

119. For an *Improved Pen Holder;* William H. Towers, Philadelphia, Penna.

Claim.—"The combination of the sponge with the lever and pen."

120. For an *Improvement in Dies for Bolt Forging Machines;* John J. Willmarth, Northbridge, Massachusetts.

Claim.—"The tapering conical dies."

121. For an *Improved Paper Ruling Machine;* T. J. Baldwin, Bridgeport, Connecticut.

Claim.—"Lifting the pens from the sheets of paper at the proper intervals, by means of the mechanism, viz: having the front edges of the sheds, as they move along on the endless apron, strike against a pendant attached to a pulley on a transverse shaft on the frame, said shaft being provided with a pulley at one end having a recess or groove cut in its periphery, and a cam, the pulley, O, working on bearings on a pulley, M, underneath it, said pulley, M, being driven by a belt from the driving shaft; the cam operating a lever, by which the spring clutch is allowed to act and connect the pulleys at one end of the drum, the projections on the lower pulley, N, raising the pen stock so as to leave the blanks or spaces at the desired parts of the sheets."

122. For an *Improved Piano Forte Action;* Stephen P. Brooks, Suffolk, Mass.

Claim.—"Transferring the blow from the key lever to the hammer, by means of the vertical bar, whereby I am enabled to place the action below the level of the keys. Also, attaching the damper arm to the vertical bar in such a manner that the up and down movement of the said bar will alternately bring the damper against the string, and relieve it from the same. Also, the means used for keeping the hammer close to the string after the blow has been given, the same consisting of a nut attached to a vertical bar, and actuated by the key lever."

123. For an *Improvement in India Rubber Springs;* Wm. F. Converse, Harrison, O.

Claim.—"The method of confining a cylindrical or prismatic block of india rubber at all points of its surface, by means of a jointed or otherwise flexible cylindrical strap, connected to double levers, or their equivalents, for applying the compressing strain convergently or radially upon the inclosed rubber. Also, in this connexion, the adjustable end plates for securing the rubber from lateral expansion, and for graduating the elastic force of the spring, if desired, by means of screw nuts, or equivalent devices."

124. For an *Improved Arrangement of Rollers for Making Metal Tubes;* Martin R. Griswold, Watertown, Connecticut.

Claim.—"The arrangement of the adjustable smooth or serrated rollers whose axes cross each other, with the guide plate and slides, and guide rollers, for making seamless metal tubes."

125. For an *Improved Hay Press;* Pells Manny, Waddam's Grove, Illinois.

Claim.—"Having the followers arranged or placed so as to cross or intersect each other at right angles and inclined, and having the doors at each end of the box or case also inclined to correspond inversely with the followers, for the purpose of having the hay compressed in the form of square bales, the line of pressure being diagonally through the bale, or the followers and doors exerting the pressure on the four sides of the bale, whereby little or no pressure is exerted against the sides of the box or case."

126. For an *Improvement in Gas Cooking Stoves;* Andrew Mayer, Philadelphia, Pa.

Claim.—"The arrangement of the gas lamps or burners, with their overhanging perforated plates or openings, side apertures or passages for distribution of the heat oven, and hot air chambers or boxes situated at the sides of the oven within the body of the stove, and provided with lids and side valves."

127. For an *Improved Slide Rest for Lathes;* C. A. Noyes, Pittsfield, Mass.

Claim.—"Constructing the slide rest, viz: having the top of the sliding box rest upon a shaft, and inclining or tilting said top by means of the screw, toothed wheel, pinions, screw rods, and nuts, whereby the edge of the cutting tool, which is secured on the upper surface of the top, may be raised or lowered as desired, and presented in a proper position to the article to be turned."

128. For an *Improvement in Life Preserving Doors;* J. T. Pheatt, Toledo, Ohio.

Claim.—"The arrangement of the inflatable water proof coverings or bags, on or over the panels, and within, or below the face level of the surrounding and intermediate frame work of the paneled door or partition."

129. For an *Improvement in Cultivators;* John Stryker, Six Mile Run, New Jersey.

Claim.—"The application or use of front and rear supporters, which not only answer all the purposes of wheels, but regulate and govern the action of the coulters in the ground."

130. For an *Improvement in Grain and Grass Harvesters;* Philo Sylla, Elgin, Ill.

Claim.—"Hanging the sickle stock to the ends of the levers which carry it, by means of the hinges, or their equivalents, located at the diagonal corners of said stock."

131. For an *Improvement in Rotary Engines;* John J. Thomas, Manayunk, Penna.

Claim.—"1st, The attachment of a piston to a disk, which forms one side of the working cylinder or piston chamber, and works in contact with a bearing face on the cylinder outside of the piston, and another face inside of the piston. 2d, Constructing the engine with a central chamber within or surrounded by the working cylinder or piston chamber, and with another chamber on the opposite side of the disk which carries the pistons, and establishing communication between the chambers by a recess in the disk on one side of the piston and between the chambers, by an opening through the disk on the other side of the piston, either of the said chambers being the induction or suction chamber, and the other the eduction or discharge chamber, and the said chambers supplying the cylinder and receiving its discharged contents."

132. For an *Improved Slide Rest for Lathes;* Chester Van Horn, Springfield, Mass.

Claim.—"Forming the tool block of two parts, and connecting said parts, *c* and *d*, together by a dove-tail, or its equivalent, so that the upper part may slide or work on

the lower part, the faces of the two parts that are connected being oblique or inclined, and the part, *c*, being moved or operated by a screw, or its equivalent, for the purpose of elevating or depressing the tool."

133. For an *Improvement in Metallic Hones;* Wm. H. Webb, Jr., Chelsea, Mass.

Claim.—"A hone, constructed with its sharpening surface composed of a combination of metals of different degrees of density, and arranged together."

134. For an *Improved Furnace for Locomotives;* O. W. Bayley, Assignor to Manchester Locomotive Works, Manchester, New Hampshire.

Claim.—"The arrangement of the compartments communicating with each other by the opening, and with the combustion chamber by the openings, whereby the unconsumed gases from the freshly fed fire are heated by passing over the whole length of the incandescent fire, and consumed in the chamber."

135. For an *Improvement in Rakes;* Henry Chalfield, Assignor to self and Theodore L. Snyder, Waterbury, Connecticut.

Claim.—"Constructing the teeth or tines of a rake or fork separately, with square or an equivalent form of apertures through the heads thereof, and uniting them by a single bolt accurately fitting and passing through all the said apertures, and through a similar aperture in the shank of the instrument, the teeth or tines being kept at suitable distances apart by washers or blocks placed upon the bolt between them, or by enlarging the heads thereof, for the same purpose, the whole being secured firmly together by a nut screwed upon the end of the bolt, or in any other suitable manner."

136. For an *Improvement in Folding Tops for Carriages;* William G. Foglesong, Assignor to self and Benjamin D. Anderson, Xenia, Ohio.

Claim.—"The application of a catch, or its equivalent, in front of the hinge which unites the principal bow or slat iron to the stem, for the convenient stretching, &c., of a carriage or buggy top."

137. For an *Improvement in Propellers;* Wm. D. Jones, Poughkeepsie, New York, Assignor to Henry Whinfield, City of New York.

Claim.—"The arrangement and combination of the parts forming a propeller."

138. For an *Elastic Tube Pump;* Rufus Porter, Washington, D. C., Jonathan D. Bradley, Assignors to Jonathan D. Bradley, Brattleboro', Vermont, and George Dennison, City of New York.

Claim.—"1st, The mode of equalizing the resistance by a truncated cone of gradually diminishing thickness, by which the roller may leave the tube, in combination with a lift below. 2d, The relieving the spring of the tube and the allowing the water to recede by means of jointed arms, eccentrics or cams. 3d, The mode of attaching the tube to the helical bands, by means of forming the latter in two parts, and by means of a bead or moulding on the former."

139. For an *Improvement in Sewing Machines;* E. Harry Smith, City of New York, Assignor to the Wheeler & Wilson Manufacturing Company, Watertown, Conn.

Claim.—"A discoidal shuttle, having its bearings in its periphery, and revolving around its own axis. Also, as a means of propelling the shuttle, the employment of the lune form button, which has a movement on its axis, for the purpose of allowing the thread to slip alternately into and out of the concave in its periphery, and thus pass off the shuttle."

140. For an *Improvement in Cast Iron Pavements;* George Neilson, Assignor to self and Nehemiah Hunt, Boston, Massachusetts.

Claim.—"Making a paving block with a perimeter of thirty faces, and formed by sixteen hexagons or hexagonal prisms, disposed with respect to one another, the same enabling such block, where it abuts against a contiguous block when laid in a pavement, to be supported laterally by a semi-hexagonal projection and recesses."

APRIL 24.

141. For an *Improvement in Platforms of Grain and Grass Harvesters;* Jearum Atkins, Chicago, Illinois.

Claim.—"The bars or ribs, or their equivalents, on the platform of reapers in rear of

the knife, in combination with a rake actuated by hand or by machinery, and moving above the platform, the ribs being either straight or curved, but parallel or nearly so to the travel of the teeth of the rake."

142. For an *Improvement in Spring Connecting Rods for Washing Machines;* Jason W. Corey, Crawfordsville, Indiana.

Claim.—"The coiled spring, combined with the eccentric, or its equivalent."

143. For an *Improvement in Stoves, &c.;* J. Johnson and J. E. Crane, Lowell, Mass.

Claim.—"The employment of the valve, in combination with the bridge."

144. For an *Improvement in the Manufacture of Slate Pencils;* Norman C. Harris, Poultney, Vermont.

Claim.—"Cutting the pencils, completely formed, from slabs of slate, by means of a cutter or series of cutters, grooved so as to half form the pencils on one side of each slab, and then reversing the slab, and forming the other halves of the pencils."

145. For an *Improvement in Implements for Shearing Sheep;* Palmer Lancaster, Burr Oak, Michigan.

Claim.—"The construction of the implement, viz: having a series of cutters, *f*, work over a series of stationary cutters, *h*, the cutters, *f*, having a vibratory movement given them by means of the reciprocating frame rack, pinions, F F, with pawls attached to them, and spur wheel, pinion, H, and crank pulley, the pinions, F F, being placed loosely on the shaft of the spur wheel."

146. For a *Machine for Feeding Paper to Printing Presses;* Isaac B. Livingston and Miles Waterhouse, Barnet, Vermont.

Claim.—"The use of the angular guide ways, in combination with the cross bar, or its equivalent. Also, the use of the crank, or its equivalent, working between the arms of levers, in combination with levers and cross bar. Also, the raising table, in combination with the cams, shafting and gearing, (for moving said table,) or their equivalents. Also, the combination of machinery for carrying forward the paper, a sheet at a time, and feeding it to printing presses."

147. For an *Improvement in Looms;* John G. Melville and W. Brayshaw, Wetheredville, Maryland.

Claim.—"In combination with a vibrating bar or lever, one or more segments, whose perimeters are partially provided with cog and partly with ratchet teeth, for the purpose of operating the shuttle boxes of figuring looms through the intervention of a straight rack, so that we dispense with several of the pieces heretofore used, and thus cheapen and simplify the mechanism, whilst the same ends are attained as by the more complicated machinery at present used for this purpose."

148. For an *Improved Piano Forte Action;* William Munroe, Boston, Massachusetts.

Claim.—"1st, The combination of the escapement jack and check, co-operating to sustain the hammer in position, to repeat, and prevent its rebound. 2d, The inclined escapement, as applied to piano forte and other similar actions. 3d, The application of the toggle joint to piano forte and other actions, in combination with the jack and hammer."

149. For an *Improvement in Carriage Springs;* Thos. Murgatroyd, Jr., Smithville, Canada West; patented in Canada, July 21, 1854.

Claim.—"The employment or use of the springs attached to the arms of the axles, by links, *b*, *d*, the links, *b*, being above, and the links, *d*, below the arms of the axle, the two springs being connected by stays or rods. The springs being also braced to prevent a forward and backward motion of the same, and the axles being supported or braced by the rod or brace."

150. For an *Improvement in the Combined Table and Writing Desk;* Lucius Page, Cavendish, Vermont.

Claim.—"The combination of the desk recess and the hinged box or case with the table, so as to operate therewith. Also, the combination of a reversible paper rack with the hinged box or case, provided with two sets of doors on its opposite sides, and adapted to a table so as to fold into and out of the same."

151. For an *Improvement in Machines for Polishing Stone;* Louis S. Robbins, City of New York.

Claim.—"The manipulating apparatus, (consisting of the shaft, crane, radial arm, and wheel,) in combination with the revolving and self-adjusting rubber or polisher."

152. For an *Improvement in Machines for Planing Metal;* James H. Thompson, Paterson, New Jersey.

Claim.—"1st, Planing the sides of nuts of prismatic bars, by means of a series of cutters attached to the periphery of a disk of scroll form, so that each cutter will project a trifle further from the centre or shaft of said disk, and thereby allow the whole number of cutters to pass over and plane the whole surface of each side of the nuts or bar at one revolution of the disk. 2d, The employment or use of the disk, with cutters attached to its periphery, in combination with the intermittingly rotating mandrel. 3d, Rotating the mandrel intermittingly, by means of the lever projection attached to the disk and the ratchet and drum, operated by a weight, or its equivalent. 4th, Operating the clutch by means of the radial arms, P, lever, and spring attached to the sliding bar, the arms, P, being acted upon by the arm, W, on the shaft."

153. For an *Improvement in Attaching Wheels to Harvesters and other Machines;* Abner Whiteley, Springfield, Ohio.

Claim.—"The simultaneous attachment of the wheel to or on the axle, and the axle to the plate, by means of the bolt, in combination respectively with the stud and washer."

154. For *Improvements in Harvesters;* Abner Whiteley, Springfield, Ohio.

Claim.—"1st, The arrangement of reel, cutting apparatus, and platform, all oblique to the line of draft or reel, acting obliquely over any platform, or any other substantially equivalent device, whereby the grain is at once reeled down, cut, and conveyed over the platform in a continuously straight line, and at the same time delivered at a sufficient distance from the standing grain to permit the passage of the horses between it and the cut grain when cutting the next swath. 2d, So placing the reel that the reel rods will strike the grain when they enter it, outside of the line passing through the point of the divider, and parallel to the line of draft. 3d, Placing the grain wheel in a plane intersecting the line of draft, so that it may relieve or counteract the side draft. 4th, Placing the axis of the grain wheel (when so located in a plane intersecting the line of draft,) in a plane which passes vertically through the centre of the master wheel, so that it may at the same time give ease in turning at the corners. 5th, The combination of the metal groove and the sickle, (the length of which is that of the cut of the machine,) for the purpose of enabling me to place the grain wheel opposite the end of the sickle, and at the same time with its point of bearing on the ground within the space cleared by the divider. 6th, The longer and divergent finger next to the divider. 7th, The sickle tooth, serrated on the smooth side and beveled on the other. 8th, The alternate spaces in the rear of the sickle bar and teeth, combined with the shoulders on the fingers against which the sickle bar works, for the purpose of alternating the bearings, &c. 9th, The cone on the knee lever. 10th, The combination of the rake, swinging from one arm of the reel, with the springplate guides, by which, when the rake has delivered the grain at the end of the platform, it is prevented from swinging back and coming in contact with the falling grain."

155. For an *Improvement in Forge Hammers;* John Comstock, New London, Conn., Assignor to Peter Naylor, City of New York.

Claim.—"1st, The method for regulating the speed of the blows given by a forging hammer, by the use of a tightening pulley, combined with the brake applied to the fly wheel. 2d, The method for regulating the amount which a hammer is drawn down to give the blow by rotating cams, by combining with said cams and hammer the adjustable screw shackle and lever."

156. For an *Improvement in Machines for Dressing Lawns;* R. L. Hawes, Worcester, Massachusetts, Assignor to Robert Rennie, Lodi, New Jersey.

Claim.—"The stationary heating cylinder, in combination with the hoops, having an alternate intermittent revolving motion. Also, the sectional roll, in combination with the rollers, for the purpose of drawing the selvages alternately from the machine."

ADDITIONAL IMPROVEMENTS.

1. For an *Improvement in Pen Holders;* E. W. Hanson, Philadelphia, Pennsylvania; dated April 10, 1855; original patent dated Dec. 6, 1853.

Claim.—"Constructing the thumb and finger rests, or either of them, so that they shall extend along the sides of the cylinder a greater or less distance, whether the outer corners of the same be rounded off or left full, or whether the said cylinder be adapted for fitting over the pen barrel or tube, or for attaching to the end of the stick, so as to dispense with the barrel or tube, or whether the said rests be soldered to the cylinder or cut out with the same."

2. For an *Improvement in Saddle Trees;* Wm. E. Jones, U. S. Army; dated April 17, 1855; original patent dated June 13, 1854.

Claim.—"The combination with the hinged pommel and cantle, of the self-adjusting side pieces, for the purpose of preventing an unequal pressure upon the edges of the side-pieces, however much the saddle tree be expanded or contracted."

RE-ISSUES FOR APRIL, 1855.

1. For an *Improvement in Vault Covers;* Thaddeus Hyatt, City of N. York; original patent dated Nov. 12, 1845; re-issue dated April 3d, 1855.

Claim.—"Making covers for openings to vaults in floors, decks, &c., of a metallic grating, or perforated metallic plate, with the apertures so small that persons or bodies passing over or falling on them may be entirely sustained by the metal, when the apertures are protected by glass. Also, in combination with the grating or perforated cover and glass fitted thereto, the knobs or protuberances on the upper surface of the grating or perforated plate, for preventing the abrasion or scratching of the glass."

2. For an *Improvement in Grain and Grass Harvesters;* Abner Whitely, Springfield, Ohio; original patent dated Sept. 19, 1854; re-issue dated April 3d, 1855.

Claim.—"1st, The combination of the rake, swinging or suspended from one rod of the reel, with the guides and ways, for the purpose of not only delivering the grain at the rear of the platform, but also for better directing the standing crop to the cutters. 2d, The guides for forcing the grain into the end of the reel. 3d, The latch and appendages, by which the operator is enabled to permit more or less grain to accumulate on the platform between successive actions of the rake. 4th, Placing the vibrating knife bar and cutters thereon, between alternately placed fingers, for the purpose of dispensing with the slot guards, and sustaining the line of cut by throwing the action of the alternate shear edge of the blades of said cutters on the upper and lower sides of the said fingers. 5th, The alternate edging of the same tooth, and so placing them together that the two adjacent edges of successive teeth, which act against the same finger, may be alike turned in one direction, while the next two edges, acting against the next finger, are alike turned in the contrary direction."

3. For an *Improvement in Grain Harvesters;* Aaron Palmer, Brockport, N. York, and Stephen G. Williams, Janesville, Wisconsin; original patent dated July 1, 1851; re-issue dated April 10, 1855.

Claim.—"Discharging the cut stalks and heads of grain from the main platform, on which they first fall, by means of the combination of the rake with the overhung lever, moved by gearing located within the inner edge or circle of said platform."

4. For an *Improvement in Winnowing Machines;* Benjamin D. Sanders, Holliday's Cove, Va.; original patent dated June 19, 1849; re-issue dated April 10, 1855.

Claim.—"1st, The employment or use of a vertical blast spout, gradually enlarged from its lower to its upper end, so that the strength of the blast is decreased in the upper portion of the spout, owing to the increased space or area of the spout, for the purpose of preventing any sound or perfect grain being carried with the light foreign matter, over the upper edge of the spout, the blast being formed or generated in said spout in any proper manner. 2d, The blast spout, either gradually enlarged from below upwards, or of the same dimensions throughout, and communicating with the atmospheric current through the screen, in combination with the hopper, and the fan placed at the end of the opposite vertical spout to separate the chaff and other impurities from the grain.

3d, The employment or use of a vertical blast spout, either gradually enlarged from below upwards, or of the same dimensions throughout, when said blast spout is so arranged that the grain is cleaned or separated from impurities within said vertical spout."

5. For an *Improvement in Hinge of Rolling Iron Shutters;* A. Livingston Johnson, Baltimore, Md.; original patent dated June 25, 1850; re-issue dated April 24, 1855.

Claim.—"Constructing shutters of slats of sheet metal, with joints formed by curving the edges of the slats, and securing them in place in the manner specified, viz: either by turning down projections from, or attachments to the ends of the slats, and thus forming an even edge to the shutters, or by means of wires inserted in the curves and bent or headed at the ends, the shutter sliding up and down in the grooves of the window frame in which it is placed."

6. For an *Improvement in the Construction of Moulds for Pressing Glass;* Hiram Dillaway, Sandwich, Massachusetts; original patent dated August 21, 1841; re-issue dated May 1, 1855.

Claim.—"So combining with a mould fountain or reservoir provided with a plunger, one or more matrices or moulds, that a liquid mass of glass, when pressed in said fountain or reservoir by the plunger, may be made to flow or pass therefrom and into such matrix or matrices. Also, combining with a series of matrices and a press chamber or reservoir surrounded by them, an auxiliary annular and concentric chamber formed in the two mould plates, and made to perform the function of preventing the plunger from clogging the mouths of the matrices, under circumstances as above stated, and also to prevent the chilled glass from obstructing the downward movement of the plunger. Also, so combining with the lower mould plate or movable bottom block, that the same may not only serve to form a bottom to the main and auxiliary mould chambers, or to the former, but also enable a person to detach the pressed glass or metal from the lower mould plate."

DESIGNS FOR APRIL, 1855.

1. For *Handles of Forks and Spoons;* Henry Biggins, Mount Vernon, New York, Assignor to Michael Gibney, City of New York; dated April 3, 1855.

Claim.—"The ornamental designs, with the handles of forks and spoons, and other articles of table cutlery."

2. For *Spoons;* John Graham, Providence, Rhode Island; dated April 10, 1855.

Claim.—"The ornaments and the beads with their scrolls."

3. For *Clock Fronts;* Wm. B. Lorton, City of New York; dated May 1, 1855.

Claim.—"The design and configuration of the casting, forming the front and sides of a clock case."

4. For *Cooking Stoves;* George Warren, S. H. Sweetland, and E. C. Little, Crescent, New York; dated May 1, 1855.

Claim.—"The ornamental design of cook stove plates."

5. For *Water Coolers;* Garretson Smith, Henry Brown, and Joseph A. Read, Assignors to James G. Abbott and Archilus Lawrence, Philadelphia, Pa.; dated May 1, 1855.

Claim.—"The design and arrangement of the castings, and the ornaments in bas-relief thereon."

MECHANICS, PHYSICS, AND CHEMISTRY.

*Object of Salt in the Sea.**

At a recent meeting of the Canadian Institute, a very interesting paper was read by Professor Chapman, of University College, Toronto, on the "Object of the salt condition of the Sea." Professor Chapman began by assuming that the sea was created salt from the beginning,

* From the Lond., Edin. and Dub. Philos. Mag., March, 1855.

and for some beneficent purpose; and then proceeded to discuss the views hitherto advanced in elucidation of this object. The suggestion, that the sea is salt in order to preserve it in a state of purity, was considered to be untenable for several reasons; mainly, however, from the fact, that organic impurities when diffused through a vast body of moving water, whether fresh or salt, become altogether and very rapidly lost; so much so, indeed, as apparently to have called forth a special agency to arrest the total annihilation of organized matter in its final oscillation between the organic and inorganic worlds. The author alluded to the countless hosts of microscopic creatures which swarm in most waters, and whose principal function has been ably surmised by the great anatomist, Professor Owen, to be that of feeding upon, and thus restoring to the living chain, the almost unorganized matter diffused through their various zones of habitation. These creatures preying upon one another, and being preyed upon by others in their turn, the circulation of organic matter is kept up, and carried through its appointed rounds. If we do not adopt this view, we must at least look upon the Infusoria, the Foraminifera, and many of the higher types, as scavenger agents appointed to prevent an undue accumulation of decaying matter; and thus, as before, the salt condition of the sea does not become a necessity. It was shown also, that, under many circumstances, the amount of saline matter in the sea is not sufficient to arrest decomposition. Other suggestions, to the effect that the sea is salt in order to render it of greater density, and by lowering its freezing point to preserve it from congelation to within a shorter distance of the poles, were then discussed in their more prominent relations. The value of these suggestions in a secondary point of view was fully admitted, but shown, at the same time, to be scarcely adequate to meet the entire solution of so vast and grand a problem as that which is manifestly involved in the salt condition of the sea. The freezing point of sea water, for instance, is only 31½ F. lower than that of fresh water; and hence with the present distribution of land and sea,—and still less, probably, with that which obtained in former geological epochs—no very important effects would have resulted had the ocean been fresh instead of salt. So far as regards the habitable portions of the world, the present difference would be next to nothing. Professor Chapman here submitted to the Institute a suggestion which he believed to be original, in reference to the question under discussion. He considered the salt condition of the sea as mainly intended to *regulate evaporation*, and to prevent an undue excess of that phenomenon under the influence of any disturbing causes that might from time to time arise. It is well known that under the same atmospheric pressure different liquids have very different boiling points; and in like manner, saturated solutions evaporate more slowly than weak ones, and these latter more slowly again than pure water. In sea water we have on an average about 3½ per cent. of solid matter, of which about 2·6 consists of chloride of sodium or common salt. The results of certain experiments by the author in reference to evaporation on weighed quantities of ordinary rain-water, and water holding in solution 2·6 per cent. of salt, were then given. The excess of loss of the rain-water over the water of the salt solution was, for the first twenty-four hours, 0·54 per cent.; at the close of forty-eight hours, 1·04 per

cent.; after seventy-two hours, 1·46 per cent., and so on, always in an increasing ratio; the experiments in each case being carried on for six days.

Here, then, we have a self-adjusting phenomenon, one of those admirable contrivances in the balance of forces, which an attentive study of nature reveals to us in every direction. If, other conditions being equal, any temporary cause render the amount of saline matter in the sea above its normal value, evaporation goes on the more and more slowly; and, on the other hand, if this value be depreciated by the addition of fresh water in undue excess, the evaporating power is the more and more increased—thus aiding time, in either instance, to restore the balance. In conclusion, the author pointed out that the consideration of this principle might shed some further light on the geographical distribution of fresh and salt water lakes on the present surface of the globe.

For the Journal of the Franklin Institute.

Chemical Examination of the Bakers' Bread of Philadelphia. By CHARLES M. WETHERILL, Ph. D., M.D.

Bread is the most important element of our food, not only for its nutritive properties, but because it is susceptible of adulterations, which, though they may be small in amount, are nevertheless so constantly taken into the system that they cannot fail in the end to prove detrimental to health. We find accordingly a very general prejudice against the wholesomeness of bakers' bread, and the fault is attributed to the use of alum, which is supposed to be the reason that such bread presents a finer appearance than that made at home. Although this is a vulgar error, since such fine appearance is the resul: of art, and the bread need not contain any different ingredients from that which is home-made, bakers have thrown themselves open to suspicion, for wherever the bread has been examined on a large scale, adulterations have been found present, and, in some places, are of universal use. Mr. Normandy, author of the *Commercial Hand Book of Chemical Analysis*, states in the same work that "bread really pure, that is, made altogether of genuine wheat flour, is, without doubt, to be found no where in London;" in all the samples of bread examined by him, with but one exception, alum was detected, and in that exception, like the others, a certain quantity of potato flour or pulp was found.

Liebig in his Chemical Letters* states, that he saw in an alum factory in Scotland, small mountains of finely ground flour of alum for the use of the London bakers. In the same work he gives an explanation of the mode in which alum acts upon the bread, and why it is used by the bakers. When the millers moisten their grain in order to facilitate the grinding and do not subsequently dry the flour, or when the flour is exposed to the moisture of the atmosphere, the gluten acts upon the starch to form acetic and lactic acids, which render the gluten soluble in water, which it is not originally; the dough from such flour does not rise well, and the resulting bread is heavy and of bad appearance. Several salts

* P. 541 of Third German Edition.

act chemically upon the altered gluten of such flour and render it insoluble again, so that the resulting bread becomes white, elastic, light, and as if made from the best of flour and capable of retaining more water, yielding, consequently, more bread from a given quantity of flour. The salts which produce this effect and which are used more or less as adulterations, are alum, subcarbonate of magnesia, sulphate of copper, and sulphate of zinc. The use of blue vitriol by bakers in the north of France and in Belgium, has been abundantly proved, as may be seen by a reference to Ure's Dictionary. Carbonate of magnesia, if it be not in too great an excess, cannot be regarded as injurious. Liebig has recently made some experiments upon the use of lime water in the baking of bread, and found that five pounds of a saturated solution of lime water for every 19 lbs. of flour, gave a bread of fine appearance, and which he deems more wholesome than if made by any other process, as such treatment supplies to bread the deficiency of lime which places it below peas and lentils in nutritive power.* He proposes therefore to substitute the harmless lime water, which acts in a similar manner, for the injurious adulterations in frequent use.

The above mentioned substances being used to make a fair looking bread from damaged flour and to cause it to retain a greater weight of water, another class containing chalk, plaster, lime, clay, &c., is employed sometimes, but I think rarely here, and which acts in increasing the weight of the bread ; these cannot be added to any great extent without injuring its appearance, and are readily detected by the quantity of ash yielded by incineration. Finally, potatoes, starch, &c., are added in some places to the flour, and do not act injuriously to the health, although they diminish from the nutritive power (for relative weight) of the bread, and may be regarded as adulterations when the loaf is sold at the same price as the same weight of pure wheat bread. Salæratus with the acids or salts used to liberate the carbonic acid, are only injurious when in excess in the bread ; they act economically in affording the carbonic acid which puffs up and renders porous the bread, and which would otherwise have to be supplied by the flour itself by the action of the yeast.

I am not aware whether an extended examination of the bread for adulterations has been made in any of our cities, and it seemed interesting as well as important to ascertain whether we are furnished with a pure article, or if in any other respect an advantage is taken by the bakers over the consumers of bread. It was expected that a careful examination of the bread of 24 bakers taken indiscriminately from all classes of bakeries, and from different parts of the city, would supply the desired knowledge, and I am happy to be able to say, that although adulterations are employed in a very few instances, our bread is generally pure. It is gratifying to learn this, and although manifest reasons prevent publishing the names of these delinquent bakers in this article, there is a law to reach them, and I am ready at any time to give their names to the proper authorities.

It was important to adopt a plan which should not occupy too much time for the examination, as the bread had to be purchased by single

* Liebig calculated the amount of lime in such bread, and finds it equal to what is naturally present in the seeds of the Leguminosæ.

loaves each day. Accordingly some preliminary experiments were made to settle upon the most expeditious method, and to test its accuracy by the examination of bread to which the adulterations had been purposely added. The method of Messrs. Robine & Parisot, consisting in soaking the crumb in water, filtering, and after evaporation, testing the aqueous solution of the residue, was rejected on account of its slowness; the filterings and pressing through linen render it difficult to get a clear solution for testing, with as much speed as by other methods. Incineration was therefore resorted to. It is important, not so much for analyses like the present as for those of agricultural and animal chemistry, to be able to obtain the ashes of vegetable and animal matters with little trouble and without losing any of their important ingredients. Perhaps the best method in use, is that of Erdmann & Strecker by the muffel, in which by the aid of a very low heat during 12 hours the dried substance is reduced to an ash of the required purity for analysis. It is rather troublesome to keep up the proper heat for so long a time, and difficult to avoid some of the ashes of the combustible mingling with those of the substance under treatment. An effort was made to substitute gas heat, which answered admirably, and which I would recommend in the preparation of ashes where gas can be obtained. Among the gas burners in use in my laboratory, is one composed of three concentric rings of $\frac{1}{4}$-inch brass tubing, the outer ring having an outside diameter of $2\frac{1}{2}$ inches and $\frac{1}{4}$-inch of space being between the rings. These rings are attached to a cross tube which delivers gas to them, and they are pierced with about 26 holes half an inch apart, and have a cylindrical or conical chimney of $6\frac{1}{2}$ inches height and of diameter at base $3\frac{1}{2}$ inches; this lamp gives an intense heat, and may be converted into a gas stove burning mixed gases, by placing a wire gauze cap upon the chimney, and igniting the gas above. This burner with the cylindrical chimney as a gas stove, was employed in the incinerations. If a large platinum dish ($4\frac{3}{4}$ inches diameter) be placed, resting on the wire gauze, it will be bathed in flame and kept at a full red heat if necessary. Two hundred grammes of dried bread could thus by a low red heat lose their combustible gases and be reduced to coal in a few minutes; this coal was then transferred to the muffel, where the incineration was completed in 6 or 7 hours. The muffel is prepared in the following way. An ordinary muffel of the dimensions $4\frac{1}{2} \times 3 \times 9$ inches, has two pieces cut from it, one at the roof and back, in which a small stove pipe of one foot height by $1\frac{1}{2}$ inches diameter is fitted, and the other in the middle of the bottom, and which is just large enough to admit the top of the cylinder of the gas stove with the wire gauze cap. A platinum tray of dimensions somewhat less than the inside of the muffel and which has its two sides bent up, serves to hold the substance to be incinerated; this is protected from the direct action of the heat, which would be too great for the incineration, by a stand of sheet iron elevated one inch above the floor of the muffel, the feet of which are made by bending down the front and back of the iron, and the sides are also bent up to correspond with the sides of the platinum tray. The dimensions of this part of the apparatus are such, that from $\frac{3}{8}$ to $\frac{1}{2}$ an inch of space is allowed on each side of the tray for the passage of the flame. The muffel is supported over the gas burner at such a distance as to yield the

most heat. More heat than is needed may be obtained by the apparatus, and when once started, no further care is required until the operation is completed. A draft over the surface of the ash is created by the chimney.

The plan adopted for the examination was to purchase every morning at the same hour of the day, a four cent loaf of fresh bread, noting the residence of the baker. It was at once weighed, cut into slices, and 200 grammes (or about 7·05 ounces, and which generally employed almost all of the loaf) placed in the gas thermostat to dry at 100°C. By the next morning it was perfectly dry, (a portion heated in a tube gave no aqueous deposit on the glass,) and was weighed again to determine the per centage of dry bread in the loaf; the whole of the dry bread was broken into pieces of an inch and heaped up in the platinum dish, where it was carbonized, and in ten minutes its bulk so reduced, that it could all go upon the platinum tray in the muffel where the incineration was completed. The ash was then weighed, placed aside in bottles, and the apparatus cleaned for the next incineration. In thus preparing the ash, not more than half an hour was employed each day in performing all the operations, including the cleaning of the platinum vessels. I determined in one experiment the amount of substance adhering to the platinum vessels, to ascertain what error it would give in the per centage calculation of the ash; the amount was 0·043 grammes, or only $\frac{2}{100}$ of a per cent. for the bread as it comes from the bakers. I also determined the silica and coal in four specimens of ash; the silica, which comes principally from the material abraded from the millstones, for curiosity, and the carbon in order to ascertain the error it would cause in the ash determination, which it was important to know, as certain adulterations are detected by the weight of the ash. The darkest specimens of ash were purposely selected—(*a*,) 2·393 ash, from 200 grms. bread, in which alum had been placed by the baker, gave silica 0·0332 and coal 0·0298; (*b*,) 2·103 ash, from 200 grms. bread, to which 0·0066 sulphate of copper had been purposely added, gave silica 0·0327 and coal 0·0223; (*c*) 2·594 ash, from 200 grms. bread, to which 0·22 alum had been purposely added, gave silica 0·0287 and coal 0·0133; (*d*) 2·227 ash, from 200 grms. of pure bread, gave silica 0·0687 and coal 0·0213. The per centage of coal and silica calculated for the original weight of the bread, is as follows:—

	Coal.	Silica.
(*a*)	0·014	0·016
(*b*)	0·011	0·016
(*c*)	0·006	0·014
(*d*)	0·010	0·034

The coal, therefore, which may remain in the ash under the most unfavorable circumstances does not influence the accuracy of the ash determination.

Before proceeding to the analysis of the ashes, some preliminary experiments were performed upon bread to which adulterations in the smallest quantity that they can be used for the best effect, were added in solution in water to the weighed bread before placing it in the thermostat. Examinations of the reagents used in the experiments for the substances sought after were also made. The chlorate of potassa and caustic potassa, yielded a small precipitate when neutralized by hydrochloric acid and pre-

cipitated by ammonia; this proved to be carbonate of lime. The caustic potassa, which was sold for chemically pure, contained platinum. The bread designated by No. 4, in the table which is to follow, having been tested several different times and found pure, was used in the experiments of adding sulphate of copper and alum.

(A) To 200 grms. of bread, 0·263 of crystallized sulphate of copper and 0·22 of alum crystals dissolved in water were added before drying the bread in the thermostat. The ash had a green tinge. The hydrochloric solution of the residue left by treating the ash with water, was boiled with caustic potassa and filtered; in the filtrate, alumina was detected by neutralization by HCl and the addition of ammonia. The precipitate by potassa when heated with ammonia and carbonate of ammonia, gave a blue filtrate containing copper.

(B) To the same portion of the bread from another day's baking, 0·0066, sulphate of copper was added in the same manner; the ash was still decidedly greenish in places; the precipitate from the hydrochloric solution by potassa was treated as in (*a*) with the same results, the ammoniacal solution was blue and gave a black precipitate by *sulphuretted hydrogen.*

(C) The same bread containing 0·22 alum to 200 grammes, treated in the same way, gave a precipitate of alumina.

(D) To bread from the same bakery, the same quantity of alum as in (C) was added, and alumina detected in the same manner as before; the residue from the boiling with caustic potassa, was boiled for a considerable time with fresh potassa, which took up an additional minute quantity of alumina. The part of the ash insoluble in hydrochloric acid was fused with bisulphate of potassa, and in it a very small quantity of alumina detected. The alumina from the potassa solution weighed 0·0235. By a direct experiment upon the alum employed, 0·22 grammes $+HCl+NH_4O$ gives 0 0322 of alumina.

(E) contained 0·22 alum to 160 grms. The ash was boiled with acetic acid, water added, and filtered; the portion insoluble in the acid was fused with bisulphate of potassa, and the alumina precipitated therefrom in the usual manner; it weighed 0·518; the acetic solution contained no alumina.

(F) a specimen of the same bread, containing 0·22 alum to 200 bread, was treated by the addition of nitric acid to the ash, evaporating to dryness and taking up with *water;* the evolution was boiled with 20 cubic centimetres of strong potassa solution, from which, after filtration, the alumina was precipitated. The residue, after boiling with hydrochloric acid and sulphite of soda according to Fresenius' method, was boiled with 10 CC of the potassa solution and the alumina precipitated, using the precaution to destroy the organic matter in the potassa from the filter by chlorate of potassa. These two portions of alumina united weighed only 0·0178; the loss may be accounted for by not having added a little acid to the residue after it had been evaporated to dryness. Upon these experiments the method employed in the general examination was based, the ash was treated with water and a certain quantity of nitric acid added; if effervesence took place to any great extent, the presence of

salæratus or compounds containing it was inferred, for the ash of pure bread, though alkaline with water from the presence of phosphates, does not effervesce with acids. It was then evaporated to dryness, more nitric acid added, water, and the filtrate after being reduced by sulphite of soda, was boiled for a quarter of an hour with caustic potassa, which, on being neutralized after filtration by hydrochloric acid, was boiled with a little chlorate of potassa, and then neutralized by ammonia and suffered to stand in a warm place for 24 hours to detect alumina. This precipitate of alumina was tested before the blow pipe with nitrate of cobalt, and the blue color distinctly obtained. It is sometimes difficult to perform this experiment upon charcoal, owing to losing the substance when it is small in quantity or powdery, by the blast. This may be obviated by moistening it with the cobalt solution on the coal and heating it gently until it cakes together, and then transferring it to the little platinum blow-pipe spoon, where it may be heated without any danger; it is not well to treat it at once in the spoon with cobalt, as the platinum is blackened thereby, and the blue color not so easily seen. The precipitate from the caustic potassa was re-dissolved in hydrochloric acid and re-precipitated by ammonia and carbonate of ammonia; the filtrate from this precipitate was concentrated, and the blue color looked for. It was then neutralized by hydrochloric acid and saturated by sulphuretted hydrogen; this of course produced a precipitate in every case owing to the platinum in the potassa, (in the precipitate from the ammonia, platinum could also be detected). The sulphuret was, therefore, boiled with hydrosulphuret of ammonia and the residue tested for copper by solution in nitric acid, evaporation to dryness and development of the blue color with ammonia, and precipitation of metallic copper by iron. In the bread where copper was detected, the test was perfectly plain and unmistakable. In one or two other specimens of bread hydrosulphuret of ammonia left an extremely minute dark residue, but which did not give the blue color with ammonia. The precipitate of the phosphates of the alkaline earths by ammonia, contained the magnesia if any had been added as carbonate to the bread. My attention was directed particularly to this base in testing for alumina. In the case of No. 15, an abundant crystalline precipitate of phosphate of magnesia and ammonia (which was analyzed) fell on the addition of ammonia, and Nos. 22 and 23 yielded a small quantity of the same salt on standing. The precipitates of the phosphates of the alkaline earths were examined by solution in hydrochloric acid, precipitation by ammonia filtering, boiling with carbonate of ammonia, and the magnesia tested in the filtrate by phosphate of soda, and in several instances, this base was detected. In some of these cases, the magnesia so detected, may be naturally in the bread, although the phosphate of magnesia would, it seems, be separated by the ammonia, but in others it was purposely added, judging from the quantity.

These analyses were all performed in the same way, in similar vessels and with measured quantities of the reagents; the same quantity of each of the reagents was treated like the substance under examination for the avoiding mistakes, and for comparison.

The following table gives the result of the analyses:—

No.	Date, 1855.	Weight in ozs. of 4 cent loaf.	Per centage of Dry bread.	Per centage of Ash.	Remarks.
1	January 26,	10·4	64·5	1·29	Pure bread.
2	" 27,	9·78	64·25	1·54	Salæratus—magnesia.
3	" 29,	12·65	61·8	0·89	Salæratus—magnesia.
4	" 12,	10·12	50·60	0·70	Principally the crumb.
Id.	" 15,	9·87	62·8	1·11	No. 4 was the bread used for the preliminary experiments. It was perfectly pure with the exception of some magnesia, which I am not certain, from its quantity, whether it was purposely added.
Id.	" 22,	9·9	63·5	1·28	
Id.	" 24,	9·4	63·05	1·05	
Id.	" 25,	9·9	63·2	1·29	
Id.	" 30,	9·98	63·0	1·13	
Id.	February 1.	9·44	63·4	1·22	
Id.	March 5,	9·78	61·9	1·25	
Id.	" 5,	10·1			
5	January 19.	11·25	64·95	1·19	Alum found in this bread in two samples.
Id.	" 31,	10·06	64·05	1·37	Alum found in this bread in two samples.
6	February 2,	8·6	59·5	0·89	Copper detected.
7	" 3,	8·0	63·1	1·42	Salæratus—magnesia.
8	" 5,	10·47	63·3	1·29	This was the finest bread of the lot and perfectly pure.
9	" 6,	10·91	65·5	1·62	Much magnesia.
10	" 7,	10·4	61·8	1·26	Salæratus—magnesia.
11	" 8,	11·34	62·0	1·36	Salæratus.
12	" 9,	10·35	63·8	1·08	Salæratus.
13	" 10,	9·8	65·9	1·33	Salæratus.
14	" 12,	9·49	61·1	1·36	Magnesia.
15	" 13,	11·32	64·2	1·39	Salæratus—magnesia.
16	" 14,	10·49	63·9	0·75	Salæratus—magnesia.
17	" 15,	10.94	61·5	1·26	Alum and salæratus.
18	" 16,	10·64	63·95	0·97	Salæratus.
19	" 17,	11·1	62·5	1·21	A little salæratus.
20	" 19,	8·69	64·45	1·13	Salæratus.
21	" 20,	10·49	62·05	0·89	Salæratus.
22	" 21,	9·05	65·9	1·19	Salæratus.
23	" 22,	12·43	63·0	1·28	Salæratus.
24	" 23,	9·72	65·1	0·76	Salæratus, also magnesia.

It will be seen, that *alum* was detected in Nos. 5 and 17, and *copper* in No. 6.

The following table of the price of flour per barrel, is compiled from the Philadelphia wholesale market price current of the Ledger, for the time during the examination of the bread, and will enable a calculation to be made of the profits of the bakers.

Date, 1855.	Mixed.	Standard and good straight brands.	Selected.	Extra and fancy family brands.
January 15,	. .	$9·25	$9·37	$9·50 a $10·50
" 22,	.	9· a $9·25	. . .	9·50 a 9·62
" 29,	$8·75	8·87½	9·00	10·
February 5,	8·75	8·87½	9·00	9·25 a 10·25
" 12,	. .	8·87½ a 9	. . .	9·50 a 10·37½
" 19,	.	9· a 9·25	. . . .	9·50 a 10·25
" 26,	. .	8·75 a 9·	. . .	8·12½ a 10·25
March 5,	.	8·75 a 8·87½	. . . .	9·25 a 10·00

The barrel should contain, I believe, 196 lbs. of flour. According to Dumas, 100 of flour will yield 130 of bread, and assuming this to be the yield in our city, (which is probably too low a proportion, since the French bread contains more crust relatively to the crumb than ours,) 196 lbs. of flour will yield 255 lbs., or 4080 ounces of bread. Now the mean weight of the four cent loaves of the bakery, No. 4, calculated from the table, is 9·83 ozs., and that of No. 5., 10·65. If these means be used in calculating the mean weight of the bread from all of the bakeries

in the table, it will give as a mean weight of 10·3 ounces for the four cent loaf, furnished by our bakers. When the barrel, therefore, costs $9·00, the cost of the *flour* in a loaf of 10·3 ozs. is 2·27 cents, and when the barrel is at $10·00, it is 2·52 cents.

Assuming 10 ounces for the weight which the four cent loaf ought to contain, the flour in it will cost according as the flour is $9 or $10 2·20 and 2·45 cents. It will be seen from the table, that there is a variation in some of the bakeries from the standard, amounting in some instances, to $\frac{1}{5}$th the weight of the loaf.*

The fourth column in the table, indicates the per centage of dry bread in the loaf. What is lost in the drying, is water, which diminishes from the nutritive power of the bread for given weights, consequently, other things being equal, the larger the amount of dry substance yielded by the four cent loaf, the cheaper it is. The mean per centage of dry bread from all the loaves examined of bakery No. 4, excluding the first specimen, which was principally from the crumb, is 62·98, and that of No. 5 is 64·5; using these means in calculating the mean of the bread from all the bakeries, we obtain the number 63·3. The numbers represent very accurately, the per centage of dry matter in the whole loaf of bread, for it was nearly all used in the experiments. According to Dumas' examination, the French bread contains 66 per cent. of dry substance in the whole loaf, and the crumb only 44—; our bread contains not more than 63·3, which arises from the fact that the proportion of crust to crumb is greater in the former, which is, consequently, for the same weights, cheaper. Reference to the table, will show the cheapest bread in this respect.

With regard to the ash, No. 4 gives a mean per centage (the first specimen being excluded for reasons mentioned above) of 1·19, and No. 5 gives mean 1·28. The maximum per centage of ashes in perfectly pure bread, treated as in the foregoing experiments, is about 1·25. Nos. 1 and 8, designated pure bread, were perfectly free from any addition to the flour beyond salt, water, and yeast; the per centage of ash in each of these cases, is 1·29. No. 8 was the finest bread I have ever seen. Almost all of the remaining bread, with the exception of Nos. 5, 6, 17, and perhaps 9, were just as wholesome as these, the additions of salæratus and magnesia not being such as to deteriorate the bread.

It will be perceived how frequent is the use of salæratus or a similar substance among the bakers. If it is not used in too great excess the bread obtained is equally good, and it is economical in saving a waste of the flour for furnishing the gases and liquids necessary to the rising of the bread.

I have, also, in connexion with these researches, examined a baking powder, which is very much puffed in the papers, and is said to be superior to cream of tartar, soda, salæratus, &c. It is simply a mixture of these substances, with a certain amount of flour; the bitartrate of potassa and carbonate of soda or potassa, are in the proper proportions, and a particular examination for alum, vitriol, and magnesia showed the absence of these substances. I believe it to be a good article, and have heard it well spoken of in families where it is used.

* A law exists compelling bakers to sell by weight; why is it not enforced?

For the Journal of the Franklin Institute.

Propulsion by Screws with the Axis above the Water.

We have observed in the *New York Nautical Magazine*, accounts of steam vessels on the lakes propelled by screws of large diameter partially submerged. In some instances the screw has been placed astern, as is usual in submerged screws—in others, at the sides of the vessel, the shafts being parallel to the keel.

Of the kind first mentioned may be instanced the *Buffalo*, *International*, and *Oriental*, of which we quote the particulars from the *Magazine* referred to:—

INTERNATIONAL.

Hull.—Tonnage 473. Draft, loaded, 8 feet.

Engine.—Diameter of cylinder, 33 inches; stroke of piston, 4 feet. Revolutions, 46 per minute.—Non-condensing, and vertical direct acting.

Screw.—Diameter, 17 feet. Pitch, 23 feet. Weight of cast iron centre, 9500. Weight of six wrought iron blades, 4800.—Total, 14,300.

Boiler.—One, tubular with drop return flued. Steam pressure, 75 pounds per square inch.

BUFFALO.

Hull.—Tonnage, 689. Draft, loaded, 10 feet.

Engine.—Diameter of cylinder, 32 inches. Stroke of piston, 4 feet. Revolutions, 42 per minute. Non-condensing, and vertical direct acting.

Screw.—Diameter, 15 feet. Pitch, 23 feet. Weight of cast iron centre, 9000 pounds; of six blades, 3600.—Total, 12,600.

Boiler.—One tubular, up return.

ORIENTAL.

Hull.—217 feet long on load line; 33 feet 8 inches beam; 14 feet 6 inches deep from base line to plank sheer. Load line, 10 feet above base line; of keel, helm, ditto, 1 foot, giving 11 feet load draft. Midship section at that draft, 308 square feet. Displacement, 1330 tons.

Engine.—One vertical square or crosshead engine; non-condensing. Diameter of cylinder, 36 inches. Stroke, 4 feet 8 inches Revolutions, 42 per minute.

Screw.—Diameter 18 feet; immersed 6 feet 6 inches. Pitch, 23 feet; six bladed. Length 26 inches. Of hub, 30 inches.

Boiler.—One drop flue and tubular. Length, 21½ feet. Shell, 10 feet diameter—with 12 large flues above and 186 tubes below, each 3½ inches "diameter." Grate surface, 54 square feet. Fire and flue surface, 2651 square feet. Consumption of coal, ¾ ton per hour (bituminous.) Average steam, 50 to 55 pounds, cut-off at ½ stroke.

Average speed, 9 miles per hour.

The idea is in that *Magazine* credited to Mr. H. O. Perry, of the Shepherd Iron Works, Buffalo, who, in 1850, designed the machinery for the first named. A description of a similar device may be found in *Bourne's Screw Propeller*, page 17, patented in 1825 by Jacob Perkins of London. The other plan, of side propellers, is claimed to have been introduced by Captain H. Whittaker, of Buffalo, in the steamer *Baltic*. We believe, however, that the first machinery of the *Iron Witch*, designed by Captain Ericsson, some five or six years ago, and tried in New York, was based on the same idea, for which a patent had issued July 26, 1838, to F. E. Fraisinet, of Westminster, and is described in *Bourne's Screw Propeller*, p. 26. The question of originality, however, need not be discussed at present. Our object is simply to call attention to these

applications of power in the propulsion of vessels, which are, practically, novelties. Whether they can ever be introduced in the Eastern navigable rivers must depend on the speed which may be attained hereafter. For marine purposes, we should be disposed to doubt their applicability, and for inland freighting boats, which have, in many cases, to pass through canals, the side screws would be out of the question. It is possible that the large stern screws might be applied to canal boats, if made of small pitch, so that the water would not be too much disturbed laterally. As yet, the vessels driven by the new screw, have not attained any greater speed than the average of propellers now in use, nor are the data of sufficient accuracy to warrant us in stating that much reduction in slip is effected. The slip in propeller steamers need not exceed 15 to 18 per cent. in average sea weather, when the pitch does not exceed $1\frac{1}{2}$ times its diameter; a proportion which may readily be maintained for any speed (within the ordinary limits) by gearing the propeller.

We hope, however, to hear further accounts from the lake engineers of their propellers, with accurate data on which to base a comparison.

M.

For the Journal of the Franklin Institute.

Performance of the Steamship North Carolina.

The loss of this ship off Holyhead, in consequence of having been run into by the Barque *Robert*, has been reported in the daily journals, but her performance ought to be recorded in order that, taken in connexion with the dimensions of her hull and machinery, (already given in this Journal Vol. XXVIII, Third Series, p. 411,) it may add to our experience in steam navigation. The vessel was originally built for the coasting trade, and specially modelled and designed for light draft of water. She had enormous carrying capacity, was of great breadth compared to her length, and intended as a freighting steamer exclusively.

After two trips to Wilmington, N. C., in which she performed well, it was determined to send her to Liverpool for sale or a charter. She was accordingly fully decked over between her poop and forecastle, and was despatched, very deeply loaded, (to 14 feet draft) from Philadelphia early in February. It was found, in going down the river, that she steered badly, but this was attributed to improper trim, inasmuch as she had previously steered remarkably well; accordingly she proceeded to sea, encountered extremely severe weather for several days, in which she was found completely unmanageable under sail, and was therefore propelled exclusively by her machinery. At length, when five days out and off Halifax, the bad weather continuing, and having been strained about her upper works, it was deemed advisable to put back, still under her machinery only, when, within 100 miles of the Delaware Breakwater, two blades of her propeller broke off, and she came in with the remaining one. Arrived in Philadelphia, she was taken on the dock, additional keel and a fore foot put on, her rudder enlarged, her upper works refitted, and the whole hull recaulked, it being found that her hull was as strong as when built; a new propeller was put on, (differing from

the former in being but 15 feet pitch instead of 16½ feet,) and she again departed for her destination, leaving the Breakwater at 1 P. M., March 23d, loaded to 13½ feet aft, 12½ feet forward. On the passage she encountered some severe weather, but pursued her course without interruption till within six hours run from Holyhead, at 3 A. M., April 8, when run into as before mentioned, just abaft the fore chains; she sunk in seven minutes, giving the crew barely time to save themselves. Had her voyage been completed it would have been made, allowing for difference of longitude, in 15 days 9 hours from the Breakwater, which is 3200 miles run, giving a mean speed of 8½ knots an hour. At her draft, before leaving port, her displacement was 1195 tons. The consumption of coal averaged 12 tons a day or 1120 pounds an hour. Her engine averaged 26 revolutions, or 69⅓ of the propeller per minute, giving 17¼ per cent. slip. Steam averaged 23 pounds, cutting off at half stroke; vacuum 26½ inches.

The boilers made steam as freely on the last day as on the first, and with any head wind (to improve the draft) furnished more than the engine could use. The advantages to be derived from large boiler surface, can scarcely be overrated. To this, principally, must be attributed the economy in coal of the *North Carolina*, which may be stated thus: 1195 tons displacement, propelled at the rate of 8½ knots an hour, (in an average of all weathers,) one knot by the consumption of $1\frac{3}{8}^{0}$=132 pounds of coal. It should not be forgotten, that the true index of capability in steamships is to be found in the number of tons displacement, driven at a given speed over a given space, by the consumption of one pound of coal; and, it appears, by certain recent articles in the English journals, that this practical question is attracting the attention of steam engineers on the other side of the Atlantic.

The great improvements in Cornish engines were brought about by comparison of the "duty" performed; and a similar comparison of ocean steamers would tend to wholesome competition on the part of both ship builders and engineers. M.

On Steam Boiler Explosions and the Explosive Force of Highly Heated Water.* By JOHN SEWEL, Assoc. Inst. C. E., Great Western Railway, London.†

(Continued from page 343.)

3. The explosion of the "Goliah," locomotive boiler, when running on the South Wales Railway, in 1850, with nearly similar results to that of the "Irk." The inner copper fire-box was forced down; the engine broken from the tender, was raised in the air, turned end over, and carried to some distance. The engine had descended one incline, and was ascending another, when the explosion occurred. The descent would be effected with little or no steam, but which would be turned freely on to effect the ascent, causing an agitation in the boiler, and a rupture

* From the London Mining Journal, November, 1854.

† Read at the British Association Meeting, Liverpool, September, 1854.

immediately below the regulator opening took place at the unsupported angle of the copper fire-box, or the weakest part in the vicinity of the disturbed steam atmosphere.

Here, also, the running engine exhibits precisely the same feature as the standing engine did—local disturbance, local fracture, and a local concentration of explosive force overcoming the momentum of a train in motion, so far as to break away the engine, and to turn it end over.

4. The explosion of No. 137 locomotive boiler, in 1850, at Wolverton, is an instance differing from the preceding ones, by having the regulator source of agitation about the centre of the tubular part of the boiler, and not over the fire-box. The driver had turned on the steam to start the engine when the explosion took place; and the tubular part of the boiler was laid open along the underside, and torn away from the fire and smoke-boxes, which both remained but little injured. On the top side the regulator dome was blown off, and projected to a considerable distance: the longitudinal stay rods were bent upwards, or pulled from their end fastenings; the tubes were bent downwards, and one of the wheels of the engine was forced off.

Here, again, is the local disturbance, the local rupture, and explosive force, in proportion to the greater body of water in that locality than is in the locality of the fire-box. The dome being carried away removed the local abutment, and the extensive opening below gave the explosion less of the usual projectile character, and more of the rock blast nature, than when the chief body of water has to make its way to the fracture near one end of the boiler, which, gun-like, directs the course of projection in an opposite line.

5. The Midland locomotive boiler, which had been at work six years, burst in 1850, under the most ordinary circumstances, with the fire-door open, and with a pressure of only 56 lbs. per square inch on the boiler. The fire-box top was forced down immediately after the driver had been trying the gauge glass cocks, and is an instance of an explosion under circumstances which had been often previously withstood.

6. The York and North Midland boiler, which burst in 1850, when running, having the top of the copper fire-box forced down, and the engine projected about 15 yards. This boiler had also worked six years, and had doubtless often sustained the pressure which at last it failed to do.

7. The York, Newcastle, and Berwick boiler, which burst, when working, in 1850, exhibits the usual projectile force when the inner fire-box top gives way, with the addition, in this instance, of the fire-box end all blown off, followed by the smoke-door box also blown off. It was considered by Captain Wynne, that the top of the copper fire-box had been hot, from want of water, after having it examined by experienced mechanics. Here, again, is the local defect, local rupture, and exhibition of explosive force on three different points, apparently in succession.

8. The explosion of an old stationary boiler, at Wapping, is an instance of the peculiar hissing of incipient fracture being heard in time to let the hearer escape before the destructive explosion which followed took place. The engine had been started, then stopped, when the ex-

plosion took place, clearly showing the care that should be exercised in avoiding by all possible means any agitation, especially in an old boiler, where the limit between danger and safety is very little.

9. The explosion of the locomotive boiler in Longside shed, in 1853, as ably investigated by Mr. Fairbairn. The boiler was an old one, and had run 104,723 miles. The usual pressure was 80 lbs., and the steam was observed blowing off at that pressure, previous to the driver taking charge of it, when, it was said, the blowing off was stopped. It is a frequent practice to momentarily stop a safety valve blowing off, that instructions may be heard, or orders given, and this may have led to the observed stoppage. An explosion ensued, immediately under the safety valve: the outer plate of one side of the fire-box was blown off, and the inner fire-box bulged inwards by the reaction of the force, similarly to the brick-work at Hunt's Bank, and showing a similar localization of concentrated force.

In this instance also, the local agitation, by stopping the safety valve, the local rupture, and the local abutment of the acting force, are as prominent as in the other examples which have been referred to, and all compatible with a moderate pressure acting on a local defect.

Extraordinary pressure, caused by tampering with the safety valve, was one of the causes assigned for this explosion, and an investigation was ordered, under the control of Mr. Fairbairn. This was done by testing another boiler, of the same age and class, by hydraulic pressure, when leakage began at about 110 lbs. pressure, and increased as the pressure increased. It was next ascertained that steam would rise from 80 lbs. to 108 lbs. pressure per square inch in four minutes, which is valuable, as showing the danger of stopping a safety valve blowing off, with the best of boilers.

A flat sided box was made, to represent the burst fire-box, and it required a pressure of 1595 lbs. per square inch to bulge the side about one-third of an inch, which gives an idea of the explosive force which bulges brick-work and strong copper plates, or carries off well riveted domes, like a bomb shell from a mortar.

Subsequent experiments showed that it required a force of 8·1 tons to draw out a $\frac{3}{4}$-inch iron stay, screwed into a copper plate $\frac{3}{8}$-inch thick; 7·2 tons to draw out a $\frac{3}{4}$-inch copper stay, screwed into a $\frac{3}{8}$-inch copper plate; 10·7 tons to draw out a $\frac{3}{4}$-inch iron stay, screwed and riveted into a $\frac{3}{8}$-inch copper plate; and 12·5 tons to draw out a $\frac{3}{4}$-inch iron stay, screwed and riveted into a $\frac{3}{8}$-inch iron plate.

These results correspond with the known relative strength of copper and iron, when cold; but the Franklin experimenters showed the rapid loss of strength in copper as its temperature increases. At the temperature of 328° Fahr., or 80 lbs. high pressure steam (95 lbs. gross pressure), copper had lost about 12 per. cent of its strength, when cold; while iron has rather increased its tenacity, according to the same authorities.

Mr. Fairbairn's experiments are highly valuable, as indicating the strength of a well constructed locomotive boiler, but they only bear indirectly on local defects, whether original or produced by time, by vibration, by neglect, or by any other cause, or by a combination of causes. Thus, it is quite common to find many of the fire-box stays broken, and

a part of the transverse partition of the same fire-box less than $\frac{1}{8}$-inch thick, yet safely confining water under a pressure of 120 lbs. per. square inch.

There would be no comparison between the strength of the broken stays and a strip of the worn copper, yet the stays break, and the thin copper stands, exhibiting two striking practical facts for the consideration of scientific authorities.

The copper stays are found to break close to the edge of the iron plates, and appear to be liable to the same deterioration from arrested vibrations at these points, as has been ascribed to railway axles.

As copper has little more than half the tenacity of the best iron, it follows that copper stays, subjected to such concussive vibrations, would rapidly lose their cohesive tenacity, which, added to the loss of strength by the temperature, may account for their frequent failure under ordinary circumstances.

Iron stays give much greater strength, but if subjected to injurious vibrations at the edges of the plates, their ultimate fracture would be a question of time, as it is with axles. The frequent occurrence of very thin parts in the transverse copper partitions of fire-boxes, and the absence of any known explosion at such parts, is a singular practical fact in steam boiler experience.

Although the fracture of the stays is frequent at the sides and front end of the fire-box, yet none of the stays of the flat sided transverse partitions have been found broken, whilst the centre of that partition itself has been worn to less than $\frac{1}{8}$-inch thick. A specimen, cut from one of these partitions, accompanies this paper, and shows the extremely small section of copper which confined water pressed to 110 lbs. above the atmosphere in a locomotive boiler, in daily work.

There is no comparison between the sectional strength of the outside copper stays, which frequently break, and that of the strip of copper from a part where no fracture has been known to occur.

The position is one subject only to the vibration of contraction and expansion of the inner fire-box, and is also remote from the usual point of steam agitation, for it scarcely admits of a doubt that on the roof of the fire-box such a thickness of copper would soon give way. The external shell of the fire-box is subject to the jars and vibrations of the frame from traction and buffing, or compression, besides those due to it as a boiler, which lead to the fracture of the stays, and other local injuries.

It is, therefore, quite possible that experiments made on two boilers, of the same age and class, might give very different results, depending upon the circumstances of each of them. However, the fellow boiler, tried by Mr. Fairbairn, began to leak at 110 lbs. pressure, and the leakage increased as the pressure was increased. A yielding of that boiler to the extent of $\frac{1}{2000}$th part of the volume of water would give relief, but the least yielding to steam pressure calls into operation the expansive force of the water and steam, which follows up the elongation of any part once begun, until fracture ensues, when strong iron plates and riveted joints are torn and twisted like the sails and rigging of a ship in a hurricane, or trees caught in a whirlwind, for the steam and atmospheric currents are alike suddenly developed, alike destructive, and alike short lived.

10. The Rochdale boiler explosion, July, 1854. This is an instance of an old boiler, extra pressure, local defect over the fire, bad management, and agitation, causing a most disastrous and fatal explosion. The boiler had been at work for eight years, was made for pressure of 30 lbs., but urged by firing to about double that pressure, to do much more work than it was originally designed for. It was an egg-ended cylindrical boiler, about 14-horse power, and had begun to leak over the fire, but had been repaired to some extent.

Hard firing not unfrequently injures the boiler plates most exposed to it, so that the leakage may have occurred from such injury ; and the time it took to stop the leak, after the repairs, showed that it had been of a partial nature, or a patch over the old plate—a dangerous mode of repair.

On the day of the explosion the boiler had been very irregularly worked ; the engine started, stopped, and started again, causing renewed agitation, if not greater pressure, when the explosion occurred, with gunpowder-like destruction to all persons and property near it. The boiler appeared to have been first raised from its seat, and then burst into fragments, and projected in various directions. The safety-valve piece, about 50 lbs., was projected farthest, or about 300 yards, as if it had been the first point of abutment, opposite the first fracture which raised the boiler ; the whole shell of the boiler appears next to have been burst into fragments, and projected east, west, and north, by the explosion of the water into steam, with gunpowder-like rapidity and force.

Here is also the local defect, the agitation, the extra pressure, the local first fracture, indicated by the raising of the boiler, and the projected safety-valve seat, and an exhibition of explosive force so startling, that the *Times* of July 17th, compares it to thunder, and to bomb-shells exploding ; whilst, in his report to the jury, Mr. Fairbairn compares it to "the springing of a mine, which resulted in tearing the boiler into strips, and the destruction of every thing with which it came in contact."

Ordinary fractures of one part of a boiler, guide and restrain, to a certain extent, the expansion of the hot water, but when the boiler shell is laid open, as at Wolverton, in 1850, or burst into pieces, as at Rochdale, in 1854, there is no check to the instantaneous expansion of water into steam of atmospheric pressure and volume. In such cases the projectile abutment is the common centre of resistance of the expanding water and steam, similar to gunpowder, when similarly exploded. Suppose the Rochdale boiler to have had a capacity of 300 cubic feet, of which 200 was filled with water and 100 with steam, of 60 lbs., high pressure, and a temperature of 311° Fahr., the expansion would be from 300 cubic feet to 378,300 cubic feet, all but instantaneously effected.

The boiler had been pressed far above what was considered safe for some time, and thus being strained ordinarily to the full elastic limits, it burst into eight or ten pieces, tearing the boiler plates into strips, and destroying all around, precisely the same as if gunpowder, with an equal amount of expansive force, had been exploded.

It was considered that the pressure required to tear the boiler to pieces, as it was done, would be about 300 lbs. per square inch, but a very much greater force than this was called into action by the first beginning to rupture ; and if it was considered dangerous to work the boiler to 60 lbs.,

it is not likely that it ever reached any such pressure as 300 lbs. per square inch, previous to the fracture.

A careful perusal of the graphic report of this explosion in the *Times* of the 17th July last, will satisfy almost any one of the explosive action of hot water under such circumstances, and may be regarded as direct proof of the views advocated in this paper, little expected, when it was written in 1851, for a treatise on locomotives, not published.

11. The Victoria boiler explosion, near Preston, 1854. The recent explosion of the *Victoria* steamboat, on the Ribble, was traced to an original defect in the design and construction of the flue, after it had passed the ordinary inspection of a Government agent. Since the external appearance rarely indicates the local defect of workmanship, or plates, or design, some more satisfactory test becomes desirable than an eye inspection. Hydraulic pressure gives this test, and is easily applied. Thus, let a boiler, when made, be carefully measured by callippers externally, and the internal flues also. Then let it be pressed by water to at least 80 per cent. more than the pressure it is made to confine, and again measured by callippers.

The distortion, if any, would show the relative strength of the different parts, and thus point out local defects by altered form, or by leakage, or by both. A certificate of such test, and of the safe limit of pressure to be given, and a copy of it kept, as evidence against recklessness, by increased pressure, whenever it should be required.

Many other examples of explosions show how small is the limit between danger and safety, and the necessity of employing only careful, experienced men, to attend boilers: for the larger the boiler, the greater is the explosive magazine it contains, and the more dangerous any unusual agitation of its contents, caused by inattention, carelessness, or neglect.

These examples, it is hoped, will induce practical men to carefully note and report the particulars of every explosion which comes under their especial notice, that the important question of boiler explosions may be placed on a sounder basis than it has hitherto had. In all cases of judicial inquiry, this course should be adopted, and ordinary causes fully exhausted, before extraordinary ones are allowed to influence experienced men, or guide the decision of courts of law.

From what has been advanced, it is concluded:—

1. That many boiler explosions may be traced to causes only slightly varied from those in daily operation. 2. That the real strength of a boiler is far below its nominal strength, and frequently very little above the quiescent pressure of the steam in it. 3. That the explosive force of the water and steam has the gunpowder-like power of expansion, developed after their release from confinement.

—

Appendix.—*Accompanying Pieces of Copper.*—The three thin strips of copper, about 17 inches long altogether, were cut transversely out of a locomotive fire-box partition, originally $\frac{7}{16}$ inch thick. At one end the strip is No. 14 wire gauge thick, at the other end No. 11, and part of it is only 17 wire gauge thick. In area, about 24 inches by 3 inches, or 72 square inches was nearly alike thin, yet safely confined water under a pressure of 110 lbs. per. square inch, in daily working.

The strips of copper now sent are no solitary instance of the kind, but an example of the wear to which that class of transverse partitions appear to be subject, as thinner pieces have been taken out than this one on several occasions.

The curved top of the partition is about 8 inches above the curved line of the lowest tubes, and the wear seems to follow the same transverse line about 4 in. below the top, and mostly between the two upper rows of $\frac{7}{8}$-ths inch copper stays, 4 inches apart. The thinning is, however, gradual, and extends transversely from 18 to 30 inches, and vertically from 6 to 10 inches, so that it chiefly occurs above the ordinary level of the fire, and on both sides of the partition. The samples are from the side next the tubes, where the coke could not be thrown against, and usually this side lasts double the time of the side next the fire-door. In this instance the fire-door sides had been worn down, a piece cut out, and the new piece worn again to No. 15 wire gauge thick, when both back and front had to be cut out. Out of a number of cases, no instance has been seen of anything like a rupture, or even bulging, whilst on the outside shell, broken stays and bulged sides are not unfrequent.

Further Observations on associated cases, in Electric Induction, of Current and Static Effects. By Professor FARADAY, D.C.L., F.R.S., &c.*

Melloni, whose loss science must deeply feel, was engaged in the latter part of his life in investigations relating to static electricity, especially concerning induction, conduction, &c. He desired, in reference to these and the results I had published respecting the charge of, and conduction by, subterraneous and subaqueous insulated wires,† to know whether there was any difference in the *time* of transmission through such wires, of currents having greater or less intensity, *i. e.* of currents from batteries of different numbers of plates. I applied to Mr. Latimer Clark on the subject; and he with the same earnestness as on the former occasion, sought and seized the opportunity of making experiments of the like kind, and gave me the results, which I sent to Melloni. The latter published them with some observations in an Italian Journal (whose title is not on the paper which he sent to me,) and soon after he was suddenly removed from us by death. As Mr. Clark's results are not yet known in this country, I have thought that a brief account of them would be valuable. His process records, by the printing telegraph of Bain, the results obtained with 768 miles of copper wire covered with gutta percha, and laid in the ground in four lines between London and Manchester, so connected that the beginning and the end of the whole length was in London. The following are his words, dated May 31, 1854:—

"I have tried a few experiments on the relative velocities of currents of different intensities, and I enclose you some strips of paper showing the results. I was unable to equalize the deflexions of a galvanometer by currents of intensity with small plates as compared with currents from

* From the Lond., Edin. and Dub. Philos. Mag. March, 1855.

† Royal Institution Proceedings, i. 345; or Phil. Mag. 1854, vii. p. 197.

a few large plates, for no size of plate would make up for the deficiency in intensity. I allude to the form of experiment suggested by Melloni; —but I believe they will be of interest to him.

"The experiments were made through 768 miles of gutta percha wire, viz: from London to Manchester and back again twice, with our ordinary sulphate of copper batteries, plates 3 inches square, and with intensities varying from 31 cells to sixteen times 31 cells, or 500 cells.

"In the accompanying strips the upper line indicates the time during which the current was sent, being made by a local arrangement.

"The second line (of dots) indicates *time by seconds*, being made by a pendulum vibrating seconds, and striking a light spring at the centre of its arc of vibration.

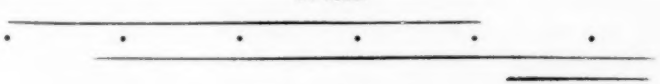
"The third line indicates the time at which the current appeared at (what we may call) the distant end of the line, 768 miles off.

"The fourth line merely shows the residual discharge from the near end of the wire, which was allowed to communicate with the earth as soon as the batteries were disconnected; this has no reference to the subject of our inquiries.

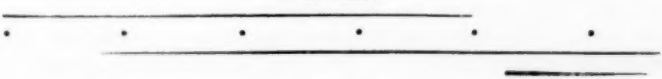
"It will be seen by the *third line*, that about two-thirds of a second elapsed in every case before the current became apparent at the distance of 768 miles, indicating a velocity of about 1000 miles a second; but the most interesting part appears to be, that this velocity is *sensibly uniform for all intensities* from 31 cells to 500."

Melloni has then given a copy of the records made when 31 pair and 500 pair of plates were employed; unfortunately the copy is inaccurate, since it makes the fourth line commence as to time at the termination of the third, whereas it ought to correspond with the termination of the first; also the third line on each does not thin off as those upon the record do. The following is a copy from other slips obtained at the same time from the Bain's printing apparatus. Experiments with 62, 125, and 250 cells, gave like results with those of 31 and 500 cells.

31 cells.



500 cells.



After certain observations, which are mainly upon the manner of the experiments, and the way in which practical difficulties were avoided, Melloni says, " it appears, then, that when the electric current possesses sufficient force to overcome the sum of the resistance offered by a given conductor, whatever its length may be, an augmentation of its intensity ten or twenty fold does not alter the velocity of its propagation. This fact is in open contradiction with the general meaning attributed to the denominations of *quantity* and *intensity;* since the first compares the mass of electricity to that of a fluid, and the second represents its elasticity or

tendency to motion. The equal velocity of currents of various tension offers, on the contrary, a fine argument in favor of the opinion of those who suppose the electric current to be analogous to the vibrations of air under the action of sonorous bodies. As sounds, higher or lower in pitch, traverse in air the same space in the same time, whatever be the length or the intensity of the aërial wave formed by the vibration of the sonorous body; so the vibrations, more or less rapid or more or less vigorous, of the electric fluid excited by the action of batteries of a greater or smaller number of plates, are propagated in conductors with the same velocity. Every one will see how the hypothesis imagined by us to give a reason for natural phenomena, will serve to suggest certain experimental investigations, the results of which will test their validity or insufficiency."

Melloni then says, that he shall shortly have occasion to publish facts which clearly demonstrate the errors of certain conclusions admitted up to the present time respecting electro-static induction; and I am aware, from written communications with him, that he considered the results arrived at by Coulomb, Poisson, and others since their time, as not accordant with the truth of nature.* In the mean time he died, and whether his researches are sufficiently perfected for publication or not, I do not know.

The uniformity in the time and appearance of currents of different intensities at the further end of the same wire in the same inductive state, is a very beautiful result. It might at first be supposed to be in opposition to the views I set forth some years ago on induction and conduction, and the statements more recently made with regard to *time*. That, however, does not appear to me to be the case, as a few further observations on Mr. Clark's recent experiments will perhaps show. When the smaller battery is used, much less electricity passes into the wire in a given time, than when the larger one is employed. Suppose that the batteries are so different that the quantities are as 1 to 10; then, though a pulse from each would take the same time for transmission through the wire, still it is evident that the wire would be a tenfold better conductor for the weak current than for the strong one; or in other words, that a wire having only one-tenth of the mass of that used for the greater current should be employed for the smaller one, if the resistance for *equal quantities* of electricity having different intensities is to be rendered equal.

My views connect the retardation of the transmitted current with the momentary induction set up laterally by the insulated and externally coated wire. The induction will be proportionate to the intensity, and therefore its especial effect on the time of retardation proportionately diminished with the less intense current,—a result of action which will aid in rendering the time of retardation of the two currents equal.

* He says, "I deceive myself much, or else the fundamental theorem of electrical induction, as we find it ordinarily announced, ought to be modified so as not to confound two effects completely distinct—the electric state during induction, and after the contact and separation of the inducing body. We know perfectly what occurs in the latter case, but not in the former," &c. Again, "In my last letter I raised doubts with regard to the consequences which have up to the present been deduced from the experiments serving as a base for the fundamental theorem of electro-static induction. These doubts have passed to a state of certitude in my mind, ... and behold me at this time thoroughly convinced that the enunciation of that theorem ought to be essentially modified." (July, 1854.)

The difference of *time* in the former experiments with air wires, and earth or water wires, very clearly depends upon the difference of lateral induction; the air wire presented a retardation scarcely sensible, the earth wire one amounting to nearly two seconds. If the insulating layer of gutta percha could be reduced from 0·1 to 0·01 of an inch in thickness, and mercury could be placed on the outside of that instead of water or earth, I do not doubt that the time would be still more increased. Yet there is every probability that in any one of these varying cases, electric currents of high and of low intensity would appear at the end of the same long wire after equal intervals of time.

Mr. Clark's results may be stated thus:—A given quantity of electricity at a high intensity, or a smaller quantity at a proportionally lower intensity, will appear at the further end of the same wire after the lapse of the same period of time. My statement assumed the discharge of the *same* quantity at *different* intensities through the *same wire*, and the quantities in the illustrative experiments were measured by a Leyden jar. In the consideration and further development of these results, it must be remembered that it is not the difference either in time, velocity, or transmission of a *continuous* current which constitutes the object in view, for that is the same both for an air wire and a subterraneous wire, but it is the difference in the *first appearance* only of the same current when wires under these different conditions are employed. After the first appearance both wires are alike in power unto the end of the current, and then a difference again appears which is complementary to the first.

There are many variations of these experiments which one would wish to make, if possible, and perhaps by degrees the possibility, or else equivalent experiments in other forms, may occur. If the wire employed were changed from a cylinder to a flat ribbon of equal weight, or to several small wires, all being equally coated with gutta percha and submerged, differences would probably arise in the time of delay with the same current; and I think that the ribbon, presenting more induction surface than the cylinder, would cause more delay; but probably any one of these, or of like varieties, would cause the *same* delay for currents of different intensities. Again, one can scarcely doubt that with different conducting substances, as iron and copper, the delay would vary, as is the case in the transmission of sound and light. That the delay for currents of high and low intensity should be the same for the same wire in any one of such cases may still be expected, but it would be very interesting to *know* what would be the fact.

The prosecution of these results and the principles concerned in them, through the various forms they may assume by such like variations of the conductors and also of the currents, offers, as Melloni has observed, most extensive and interesting inquiries: even the power of a current to induce a current in neighboring wires and conductors is involved in the inquiry, and also the phenomena and principles of magneto-electric induction.

Royal Institution, Feb. 7, 1855.

Rags and Paper. By J. B. Sharp, Esq.*

An Account of Rags *Imported into the United Kingdom, Exported from the United Kingdom, and left for Home Consumption, from* 1801 *to* 1853; *stated in Five Decennial Periods, terminating respectively in* 1810, 1820, 1830, 1840, *and* 1850, *and in the Three Years,* 1851 *to* 1853.

Years.	Import.	Export.	Left for Home Consumption.
	Tons.	Tons.	Tons.
1801 to 1810 .	30,696	11	30,685
1811 " 1820 .	38,107	1,649	36,458
1821 " 1830 .	80,088	786	79,302
1831 " 1840 .	95,203	2,138	93,065
1841 " 1850 .	74,463	2,950	71,513
1851 " 1853 .	27,997	4,762	23,235
Total Quantities imported, exported, and remaining for Home Consumption in 53 years, ...	346,554	12,296†	334,258
General Annual Average of import, export, and remaining for Home Consumption in 53 years,	6,539	232	6,307

An account of the Quantity of Paper *made, and the Gross Amount of Duty paid thereon, in the Five Years,* 1830 *to* 1834, *preceding the Reduction of the Duty; and in the last Five Years,* 1849 *to* 1853.

Year.	Pounds made.	Gross Amount of Duty.	Year.	Pounds made.	Gross Amount of Duty.
		£			£
1830, .	68,378,566	747,114	1849, .	132,132,657	859,575
1831, .	66,974,186	728,862	1850, .	141,032,473	915,121
1832, .	69,804,443	763,104	1851, .	150,903,543	993,592
1833, .	73,644,997	804,513	1852, .	154,469,211	1,000,630
1834, .	76,138,466	833,822	1853, .	177,633,009	1,148,116
Total in five years, .	354,940,658	3,877,415	Total in five years, .	756,170,893	4,917,034
Average per annum,	70,988,131	775,483	Average per annum,	151,234,178	983,407

The total quantity of material of all kinds consumed in the manufacture of paper, ranges between 110,000 and 120,000 tons per annum, at the present rate of production; and the whole of our import of such material, as shown in a preceding table, only amounts to about 6 per cent. of the entire consumption.

*From the Journal of the Statistical Society of London, March, 1855.

†Of this quantity of 12,296 tons exported, the official accounts, from which these details are derived, show that 10,146 tons were British and Irish rags, and 2,150 tons were foreign rags re-exported.

Analysis of a Surface-soil from the Desert of Atacama. By F. Field.*

On the confines of the Desert of Atacama, a few miles to the east of the port of Caldeca, in the north of the Republic of Chile, the soil for many leagues around has a perfectly white appearance, exactly as though it had been covered by a recent fall of snow. On investigation, it appears to consist of a white crystalline matter, which extends to the depth of six or eight inches below the surface; and on digging one or two feet deeper, large quantities of water are discovered, highly impregnated with saline matter. If the white substance be carefully scraped away, leaving an apparently clean surface of sand exposed to the air, crystals gradually form, and in a few weeks the spot is as white as before. The following is the composition of the substance taken from many parts of the locality above mentioned, affording a pretty correct illustration of the surface-soil of this part of the desert of Atacama:

100 grms. gave:

Soda,	27·17
Sulphuric acid,	42·60
Chlorine,	9·63
Lime,	6·72
Magnesia,	4·75
Water,	12·30

with traces of oxide of iron, potash, and carbonic acid.

Deducting an equivalent of sodium for the formation of the chloride, the following numbers are obtained:

Sulphate of soda,	41·77
Sulphate of lime,	16·32
Sulphate of magnesia,	13·75
Chloride of sodium,	15·60
Water,	12·30
	99.74

with the traces of oxide of iron, and carbonates of lime and soda.

This substance is perfectly soluble in cold water, if added in sufficient quantities, and digested with it for a long time; dilute hydrochloric acid dissolves it readily, with scarcely perceptible effervescence. It is slightly alkaline to test-paper,—due, probably, to a trace of carbonate of soda. When dissolved in water at 100° F., and allowed to cool, it deposits large crystals of sulphate of soda. I have sent home a specimen of the soil, and also some crystals of sulphate of soda produced from it by simple solution and crystallization. One pound of the soil produces more than its own weight of crystallized sulphate of soda.

I am now engaged upon an investigation of the sub-soil, taken three feet below the surface of the desert.

On the Gold Fish of Franklin†.

In a note at the foot of page 250 of the 37th volume of the *Philosophical Magazine*, a question of interest both in a mechanical and electrical point

* From the Lond. Journ. of the Chemical Society, Jan. 1855.

† From the Lond., Edin. and Dub. Philos. Mag., March, 1855.

of view is suggested by the following statement of Prof. W. Thompson:—"*The phenomenon of a solid body*," writes Mr. Thompson, "*hovering freely in the air, in stable equilibrium, without any external support, has never, I am convinced, been witnessed as the result of any electrical or magnetical experiment.*" An experiment described by Franklin, and redescribed by Prof. Srtsczek of Pesth,* without any knowledge of what Franklin had done previously, seems to furnish the precise fact alluded to by Prof. Thompson. If the knob of a charged Leyden jar be caused to approach a number of scraps of gold leaf, the consequent jumping of the leaves is well known. If a certain shape be imparted to the gold leaf, when the knob is approached the leaf is attracted and moves towards the knob; but, before it reaches the latter, it is arrested, and hovers in the air, like a fish in water. When the atmosphere is dry, the leaf can be preserved swimming for hours together "without any external support or constraint."

The following description of the experiment by Prof. Srtsczek is taken from Poggendorff's *Annalen*, Vol. lxxxviii, p. 493.

Let a small Leyden jar which can be held conveniently in the hand be charged with, say, positive, electricity. Let the knob be gradually brought near to several bits of gold leaf lying upon clean paper, from 6 to 12 lines in length, and from a line to a line and a half in width: they may be rectangular, lozenge-shaped, trapezium-shaped or triangular.

A jumping of the leaves immediately commences, but soon the remarkable fact will be witnessed that one or more of the scraps will suddenly halt in their movement, and remain freely floating in the air; sometimes rotating round the knob of the jar, and showing a tendency to rotate round their own axes.

The knob must reach several inches above the insulated rim of the jar, so that scraps which hover at a considerable distance may not be attracted by the rim. At the conductor of a machine, the swimming of the gold-leaf is also seen at a much greater distance (a foot for example,) but the experiment does not succeed so quickly. The leaves must be smooth, and of an elongated shape.

With the same strength of charge, portions of gold-leaf, equally long, but of different shapes, hover at different distances from the knob.

With the same charge, and scraps tolerably alike in shape, the long ones hover at greater distances than the short ones. This is most plainly seen when the experimenter succeeds in causing several scraps to swim at the same time.

When the charge diminishes in intensity, the leaves slowly approach the knob of the jar; when, however, by means of the knob of a second jar, electricity is communicated to the former, the leaves again recede. In this manner, when the air is dry, a scrap of gold-leaf can be kept swimming for hours.

In some cases the rotation first begins when the floating leaf comes near to the jar, and the rotation is accelerated as the leaf approaches.

With scraps of a suitable shape, the equilibrium is so stable that the upright jar may be suddenly pulled downwards, without altering the hovering condition of the scrap of gold-leaf.

* And, we believe, exhibited in a modified form by Professor Faraday in his public lectures.

From the side of the leaf most distant from the jar, electricity is given off of the same name as that wherewith the jar is charged; and it has the power of propagating itself to a considerable distance. When a gold-leaf electroscope is placed near the "fish," a permanent divergence is observed after the instrument has been removed.

When the swimming leaf is removed from the neighborhood of the knob, by suddenly withdrawing the jar, it is found that those pieces which swim at about an inch distance are in a neutral condition; while those which swim at a less distance are negative. Only such as, while swimming, come very near the knob of the jar, show sometimes positive electricity.

In a note to this paper, Prof. Poggendorff remarks:—"Although the more recent treatises on electricity do not mention the fact above described, still it is not new, the experiment having been made by Franklin, in 1749, on the conductor of an electric machine, (see *Experimental Observations on Electricity*, &c., London, 1769, p. 72). The free hovering of a piece of gold-leaf, in so stable a position, must always be regarded as a most remarkable fact, which is deserving of revival, particularly as very few appear to be acquainted with it."

In the following volume of the *Annalen*, p. 164, Prof. Riess makes the following remarks:—"A bit of gold-leaf, *differently* pointed at its ends, and with its blunter end towards the conductor of an electric machine, flies towards the latter, and remains floating at a distance from it, because the electric wind generated at the blunter end drives it back, while that generated at the sharper end and the electric attraction drive it towards the conductor. A point on the side of the strip of gold-leaf must cause an axial rotation. The same action may be observed with a sewing-needle which has its eye broken off. When it is suspended horizontally and the knob of a Leyden jar is carefully brought near it, at a certain distance from the knob the pointed end is strongly repelled, while the blunt end is attracted."

We may add to these remarks, that in some cases we have succeeded in causing a bit of gold-leaf to flutter so speedily as almost to obscure its shape, and give it the appearance of an insect busily plying its wings. When the hand is approached, the fluttering ceases, and the little swimmer floats tranquilly in the atmosphere. So strong is the electric wind proceeding from the floating scrap, that it can be distinctly felt, as a cold draft, at a distance of five or six inches.

---

*New Jointing for Gas, Water, and Steam Pipes.**

Messrs. William Smith and Thomas Phillips, of Snow-hill, have patented a new model of constructing and connecting pipes or tubes for gas, water, or steam purposes, consisting of forming at the ends of each length of pipe or tube a narrow rim, with bevelled edges, so formed that when one length of pipe or tube is placed in connexion with another, the bevelled edges thus brought together, formed between them a ring or

*From the Lond. Builder, No. 637.

groove to receive suitable packing. The joints when packed are enclosed and held together by socket pieces, formed to act upon the rims for that purpose. These socket pieces are formed in halves, with flanches for screws to hold them together when applied to the junctions of the pipes. It is also proposed to form the end of the pipes at an angle to a line drawn through such pipes in the direction of their length, by which the continuance in a straight line, or a divergence therefrom in several lengths of pipe, is affected by the position of one pipe or tube next to be connected in relation to the preceding. The angular end of one piece will make up for the angularity of that preceding, in order to maintain a straight course; but by turning the pipe or tube partly round, a divergence from the straight line will be more or less obtained, whereby the use of curved or bent pipes may in a great measure be dispensed with.

For the Journal of the Franklin Institute.

Particulars of the Steamer Astoria.

Hull built by William H. Webb, New York. Machinery by Hogg & Delamater, New York. Intended service, San Francisco to Cilka.

HULL.—

Length on deck from fore part of stem to after part of stern post, above the spar deck,	160 feet.	
Breadth of beam at midship section above the main wales,	25 "	
Depth of hold,	12 "	
Draft of water at load line,	8 "	6 inches.
Tonnage,	500.	
Area of immersed section at load draft,	127 sq. feet.	
Masts and rig,	Barque.	

ENGINES.—Vertical direct.—

Diameter of cylinders,		26 inches.
Length of Stroke,	2 feet	2 "

BOILER.—One—Return flued.—

Length of boiler,	22 feet.	
Breadth "	5 "	6 inches.
Height " exclusive of steam chimney,	9 "	6 "
Number of furnaces,	2.	
Length of grate bars,	6 feet	6 "
Number of flues,	10.	
Internal diameter of upper flues,	1 foot	7 "
Heating surface,	1200 sq. feet.	
Diameter of smoke pipe,	3 feet.	
Height "	24 "	
Description of coal,	Bituminous and anthracite.	
Draft,	Natural.	

PROPELLERS.—

Diameter of screw, (Griffith's,)	9 feet.	
Pitch of screw,	16 "	
Number of blades,	2.	

Remarks.—Floor timbers at throats, *molded* 12·5 ins.; *sided* 5 inches. Distance of frames apart *at centres* 30 inches. Propeller fitted to hoist out of water. H.

For the Journal of the Franklin Institute.

Particulars of the Steam Boat Elm City.

New York.—Hull built by S. Sneden, New York. Machinery by Neptune Iron Works, New York. Intended service, New York to New Haven.

HULL.—

Length on deck,		280 feet.
Breadth of beam at midship section—*molded*,		35 " 2 inches.
Depth of hold,		11 "
Draft of water at load line,		5 " 6 "
Tonnage,	1100.	
Area of immersed midship section,		175 sq. feet.
Masts and rig,	none.	

ENGINE—One—Vertical beam.—

Diameter of cylinder,		65 inches.
Length of stroke,		12 feet.

BOILERS—Two—Return flued.—

Length of boilers,		32 feet 6 inches.
Breadth "		11 "
Height " exclusive of steam chimney,		10 " 3 inches.
Number of furnaces in each boiler,	2.	
Length of grate bars "		8 feet.
Number of upper flues "	5.	
Internal diameter of upper flues,		1 foot 5½ inches.
Heating surface,		3556 sq. feet.
Grate surface,		162 "
Diameter of smoke pipes,		4 feet 10 inches.
Height " "		32 "
Number of " "	2.	
Description of coal,	Anthracite.	
Draft,	Fan blast.	

PADDLE WHEELS.—

Diameter,		34 feet 6 inches.
Length of blades,		9 "
Depth "		30 "
Number "	28.	

Remarks.—Floor timbers at throats, *molded* 16 ins.; *sided* 11 ins. Distance of frames apart *at centres* 24 ins. H.

Silicate of Soda as a means of fixing Aluminous and Iron Mordants.

By Prof. BOLLEY.*

The use of silicate of soda in calico printing has the advantage of rendering the colors deeper than when the dung-bath alone is used. In reference to the action of this salt, it is worthy of remark that alkaline silicates exist in cow-dung, which according to Rogers contains 17·5 per cent. of solid substance; 15 per cent. of this is ash, so that the fresh dung contains 2·6 per cent. of ash, and the ash contains 62·5 per cent. of silica. A large portion of this silica is in the insoluble condition, but the quantity of soluble silica is not inconsiderable. The soluble portion of the ash amounts to 38 per cent., and of this, 12 per cent. is silica, and 10 per cent. potash and soda.

There is therefore reason for regarding silicate of soda, as the efficient ingredient of cow-dung. C. Kœchlin found that the constituents of mor-

* From the Chem. Gaz. No. 295.

dants are met with in the dung-bath after being used, and that the alumina is in solution; whence it must be inferred that a part of the aluminous mordant is dissolved in the dung-bath. However, it still remains to be ascertained in what manner this is effected, what the solvent is, and why the alumina is not precipitated by the salts in the dung. But, on the other hand, it is known that aluminous salts, and even alkaline solutions of alumina and phosphate of alumina, are decomposed by silicate of soda, while insoluble silicate of alumina is formed. Considering all these circumstances together, there are grounds for the opinion that the mordant is converted by silicate of soda into an insoluble state, which is wholly unaffected by the dung-bath.—*Schweizerisches Gewerbeblatt*, May, 1854.

---

*Beaumont's Hollow Cone Disk Pressure Gauge.**

A new modification of the aneroid gauge for ascertaining fluid pressures, is exhibited under two views in the annexed engravings. Fig. 1 is a face elevation of the gauge, showing the internal pressure chamber, and the means of actuating the index hand. Fig. 2 is a section of the pressure chamber detached. The flat shallow case, A, similar to that

Fig. 1.

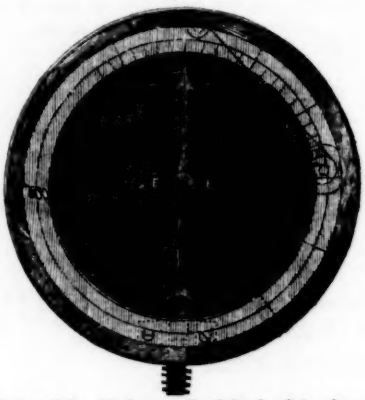
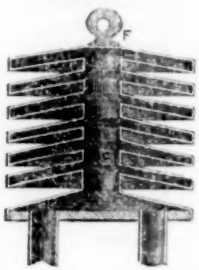


Fig. 2.



used by Mr. Sidney Smith in his ingenious elastic diaphragm gauges, contains the compound pressure chamber, which is composed of a series of hollow saucer-like disks, B. These hollow disks are put in communication with each other by a central pipe, C. There are two sets of the disk chambers, one set on each side the index centre, and set in reverse directions. In applying the gauge to a steam boiler, the instrument is screwed on to the boiler at D, and as the steam enters by this passage, it finds its way up into all the disk chambers which are beneath the index centre. Passing from the bottom disk, up to the top one of this series, the steam current emerges by the two pipes, E, and passes thence through all the disks above the centre. The entrance pipe at D is fast to the containing case, whilst the upper end pipe, F, is free to move, to accommodate the series of chambers to the internal pressure. The connexion of the several disks, through their central pipe, being

* From the Lond. Pract. Mech. Journal, February, 1855.

by the alternate sides of the disks, a delicately elastic chamber is produced, so that the slightest variation in the internal steam pressure, constantly tending to flatten the external cone surface of one disk, and to bulge still more the internal cone surface of the opposite disk, causes a pretty extensive traverse of the end, F. This end is connected to a cord or fine chain, G, passed over guide pulleys, and thence round the index hand pulley, being finally attached at its opposite end to a reaction helix, H. The pressure is pointed out by the rotary traverse of the index hand upon the graduated edge of the case.

Notice of the Application of the Thistle to the Manufacture of Paper. Patented by Lord Berriedale, London, July 8, 1854.*

Whilst India and other tropical regions have been traversed in search of a plant to be used in place of rags in the paper manufacture, Lord Berriedale has turned his attention nearer home, and has selected the common thistle as the most suitable plant for his purpose. His invention relates to the application and use of the common thistle, or *Carduus*, as it is termed, according to the botanical classification of Linnæus, in the manufacture or production of pulpy material from which paper is to be made, as well as in the manufacture of a fibrous material for textile purposes. All the varieties of the thistle plant are applicable for the purposes of this invention, but more particularly the large Scottish thistle, which grows luxuriantly in many parts of the British islands, attaining a great height and thickness of stem. Such thistles furnish, in each plant, a large amount of long fibre of great tenacity, and which, when duly prepared, is most excellently suited for the preparation of a powerfully cohering paper pulp, as well as for use in textile manufactures.

In adapting the thistle to the manufacture of paper pulp, the plant is used either in a green or dried state. If employed in its natural green condition, it is cut or gathered, and at once beaten or broken up by any suitable mechanism, such as is used in the primary treatment of the flax plant, so as to disintegrate the fibrous or ligneous matter. During this breaking treatment, the mucilaginous and aqueous matter present is washed clear away, either by pure water, or by an acidulous solution, or by any other economical and effective cleansing agent. When the thistle stems are thus fully reduced or disintegrated, the resultant fibrous mass is worked up or macerated in the usual manner, for the production of a pulp suitable for the use of the paper-maker. This pulp may be used in the manufacture of paper, either unmixed, or commingled with other materials already in use for making paper. The routine of manufacture into paper of the pulp, is similar to that pursued with the ordinary rag pulp, or it may be varied, as the properties of the thistle may suggest. The thistle fibre being strong, the paper made from it is of great tenacity, the fibres cohering well together in the paper machine, and being worked up with very little loss from washing away. The fibres are also of good color; hence paper of a fair color may be made from them without bleaching, and if bleaching is resorted to, a very good white color is obtained at a slight expense. The mucilaginous or gummy matter dislodged from the fibres may be collected and applied in the

* From the Lond. Pract. Mechanics' Journ., March, 1855.

manufacture of gum or glutinous matter, or it may be otherwise rendered commercially valuable, so as still further to economize the thistle manufacture. In applying the thistle plant to the manufacture of textile materials, the fibres are primarily prepared in the manner already described, and then subsequently treated according to the existing textile processes —such, for instance, as are adopted in the flax manufacture, the thistle fibre being closely allied to the fibre from the flax plant, as regards its general characteristics. Being strong and of good staple, the thistle fibre is particularly well suited for the spinning and weaving processes.

For the Journal of the Franklin Institute.

Performance of Shawk's Steam Fire Engine.

The engine "Young America," made by Abel Shawk of Cincinnati, was tried a few days since in the yard of the Moyamensing Prison. Owing to the distance of this point from the Water Works, a sufficient quantity of water could not be obtained to supply the pump. Another trial was, therefore, held in Arch street above Tenth, fronting the Presbyterian Church, when the powers of the engine were fully tested and compared with those of the best hand engines in the City.

The peculiarities of this engine may be briefly stated in a description; the boiler consists of a case about 3½ feet and 4 feet to 4½ feet high with arched top, beneath which the fire is made, containing a continuous series of small tubes laid parallel and in close proximity, between which the flames ascend; in connexion with this chamber, and lying horizontally very near the ground, is a cylinder about 10 feet long and 2½ feet diameter divided into two unequal parts by a vertical transverse diaphragm, in the larger of which, near the boiler, is another continuous series of small tubes, the space left around them being connected with the end of the first series of tubes; the other end of this first series, and one end of the second series are in connexion with the force pump. The operation of the boiler is as follows:—Fire is first made and the first series of tubes heated; water being then injected into it becomes instantly converted into steam, which, in traversing its length, becomes highly superheated, and thence entering the cylindrical case, imparts its superfluous heat to the water injected into the second series; and this, being converted into steam, unites with the steam first made, (which has been reduced in temperature nearly to that of saturated steam) and both are admitted to the engine. The use of this arrangement in dividing the tubes, we presume to be convenience in the disposition of the heating surface, while the principle of injecting water into hot surfaces obviates the necessity of carrying large quantities of water, and enables rapid generation of steam. The following results were obtained: Steam formed in 5 minutes 15 seconds after the torch was applied; the water injected was cold. One minute afterwards the gauge showed 15 pounds per square inch, and in 7 minutes 20 seconds after lighting, 50 pounds; at 8 minutes after lighting the pump was put in motion, the steam thereafter rapidly rising to 120 pounds, at which point the safety valve raised while the engine was at work. So far as the operation of the boiler was concerned, the performance was admirable.

We have said that the horizontal cylindrical case was unequally divi-

ded. The smallest part, at the end furthest from the boiler forms the receiving tank for the pump, and is provided with a suction nozzle having eight attachments for hose. On the top of this, is the pump, $7\frac{3}{8}$ inches diameter, and in line with it, towards the boiler, the steam cylinder $11\frac{3}{8}$-inches diameter, both allowing 25 inches stroke of piston and connected by one rod; on which a three armed cross-head is fixed. The two lower arms work the force pumps which are disposed parallel to and alongside of the cylinder. The upper one works a small valve, which admits steam alternately on either end of a small cylinder, to the piston rod of which is affixed the main valve for governing the admission and exit of steam to the main cylinder. The object of this arrangement is to permit the main piston to complete its stroke before reversing its movement. The engine is in fact, a direct double-acting steam pump. Its operation was very satisfactory, and in appearance, finish, &c., unexceptionable.

Its performance in throwing water was as follows:—

Through one $1\frac{1}{8}$ inch nozzle 172 feet horizontal distance (against the wind); 120 feet vertically from the nozzle. Through four $\frac{3}{4}$-inch nozzles about 100 feet. Through 62 feet of hose, one 1 inch nozzle, 176 feet from the end of it or 238 feet from the engine horizontally; through two nozzles one 1 inch and $1\frac{7}{8}$ inch each through 62 feet of hose 103 feet from the nozzle or 165 feet from the engine horizontally. The greatest height thrown by the best hand engine was 2 feet higher *above the nozzle* (which stands 11 feet higher than that of the steam engine,) with a $\frac{7}{8}$-inch nozzle. This was done for a moment only and when fully manned.

On a trial with the suction apparatus attached, drawing water from the Delaware, the performance was as follows:—

Against a moderate breeze, with $1\frac{1}{4}$ inch nozzle, 176 feet horizontally, excluding spray. Through 50 feet hose and same nozzle, 157 feet. Through 325 feet hose and $1\frac{1}{8}$ inch nozzle, 120 feet against, and 151 feet with the wind. Through 685 feet hose and 1 inch nozzle 96 feet with the wind. Through 925 feet hose and $\frac{3}{4}$-inch nozzle stream thrown vertically 40 feet at 70 feet horizontal distance. Pressure of steam carried 96 pounds per square inch.

Mr. Shawk's engine is the best attempt at a steam fire engine we have seen, and is in every way creditable to him as inventor and builder. We hope soon to see more than one of them in use here. No doubt many improvements may and will be made in it. Among others something should be done, if possible, to diminish the noise made, which is very great, on account of the sudden discharge of steam. Perhaps a crank motion may be advantageously introduced. We hope the talents of the engineering profession will be brought to bear on this question, which is one of great practical utility. M.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, May 17th, 1855.

B. Howard Rand, President, pro tem., in the chair.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Donations to the Library were received from the Institute of Actuaries;

The Society of Arts; The Geological Society; and The Royal Institute of British Architects, London; Paul K. Hubbs, Esq., California; James B. Francis, Civ. Eng., Lowell, Mass.; The Young Men's Association, Buffalo, New York; The Pottsville Scientific Association, Pottsville, Penn.; The Trustees of the Girard College for Orphans; The American Medical Association; and Messrs. Edward Miller and B. Howard Rand, Philadelphia.

Donation to the Cabinets, from Edward Miller, Esq.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer's statement for April was read.

The Board of Managers and Standing Committees reported their minutes.

Resignations of membership in the Institute by four gentlemen were read and accepted.

The candidates for membership in the Institute, (8,) were proposed, and the candidates proposed at the last meeting, (6,) were duly elected.

A working model of Mr. Thomas Silvers' Patent Marine Governor, was exhibited to the members and explained by Washington Jones.

It is designed to regulate the admission of steam to the engines of steamships. Many plans have been tried to effect this desirable object, but none have been perfectly satisfactory in their action. The ordinary pendulum governor will act, so long as its spindle maintains a vertical position, and the balls are not constrained to revolve in a plane which forms an angle with the horizon; such a condition is obtained, only while the vessel is free from pitching, and when she is so, there is but a comparative small amount of variation in the work to be performed, and consequently, no governor is required. It may be described as an ordinary pendulum governor, with the usual spindle, links, sliding collar, and lever for attachment to the throttle valve, but having the arms prolonged above the joint pins that suspend them to the spindle, until they are of the same length as the par below, and having balls of equal weight upon each end. The balls being in equilibrium, it is evident, will revolve in any plane, no matter what its inclination to the horizon; and also, that as the velocity of revolution diminishes, the balls have no disposition to approach the spindle, the action of gravity being rendered inoperative by the arrangement of the parts. Its function is supplied by a spring coiled around the spindles, and attached to it at one end by a screw and nut to regulate its tension, and connected at the other end by links to the arms. The centrifugal force carrying the balls from the spindle gives a greater amount of tension to the spring, and when the speed slackens, the balls are brought together by the effort of the spring. The model works well, and if proper appliances are used to communicate motion to the practical governor, there is no doubt of its performing equal to the expectations that are entertained of it.

The plan is about to be tested on one of the ocean steamers, and if successful will, most likely, be placed on all of them.

A picture taken by Mr. Mascher's newly discovered process, (described pp. 344 to 347, of this Journal) was sent by him for the inspection of the members. It is a very good specimen of daguerreotyping, all the objects being distinctly shown and well defined.

Mr. G. W. Risdon brought for examination a breech-loading rifle, patented by A. D. Perry, having a self-capping arrangement placed in the stock. The chamber is a rectangular piece of metal, with a continuation upon the lower side of the back end, forming the guard for the trigger, and a lever, whereby the chamber is moved upon a joint pin that passes through it, and two plates, one on either side of the barrel, and the stock at right angles to the trigger. When the trigger guard is moved from the stock, the fore end of the chamber rises to receive the charge; the nipple comes opposite a tube containing caps, one of which is forced outward and upon the nipple and is carried up when the chamber is returned to its place. The recoil does not come upon the joint pin, but on the shoulder at the back end of the chamber, that, as well as the muzzle end, being rounded to a circle described from the centre of the pin, and being a very neat fit when in its place, ready for firing.

Mr. H. Howson exhibited a very complete working model of an apparatus for removing and replacing the wheels of locomotives and cars, the invention of Mr. John Fouser, of this city. The locomotive or car is moved on to a platform, which is on a level with the track, and which is arranged so as to be raised or lowered in a pit by means of a series of screws operating within stationary columns secured to the masonry, which forms the walls of the pit. The screws are connected by means of double jointed rods to the ends of strong cross bars underneath the movable platform.

On the tops of the columns are worm wheels, secured to the nuts of the perpendicular screws, and into these wheels gear a corresponding number of worms on longitudinal shafts. These shafts may be operated by hand or by belts from any adjacent power. On the locomotive or car being placed on the platform, adjustable levers are placed with their points under the frame of the locomotive, under the edge of the fire-box, or other stationary portion of the engine, the weight of which rests on the levers. The platform is now lowered, and with it the wheels and axles, until sufficiently low to enable the wheels to be rolled clear of the engine, when the platform is again raised to a level with the track, along which the wheels may be removed to any distance required.

Mr. Howson remarked, that the inventor calculates the cost of the machine at from eight to twelve-hundred dollars, according to the size, and that by its assistance and the work of two attendants only, the whole of the wheels of a large locomotive can be removed and replaced in less than one hour.

The model is now on exhibition at 6, Forrest Place, 55 South Fourth Street, Philadelphia.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on Mr. Tasker's Self-Regulating Water Furnace.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination, "a Self-Regulating Water Furnace," invented by Mr. Thomas T. Tasker, of Philadelphia, Pennsylvania—REPORT:

That the furnace of Mr. Tasker is arranged to warm buildings by means of air which has passed over pipes, within which hot water is

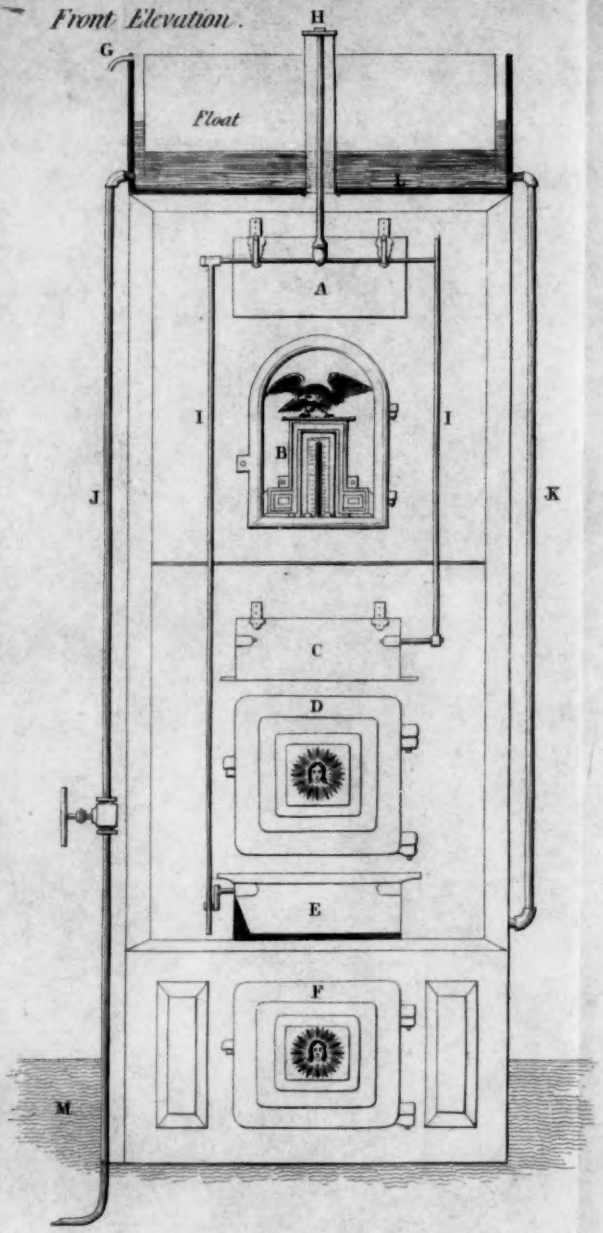
circulating; and the peculiarities consist partly in the novel construction of the furnace itself, and of the sets of water pipes communicating with it, so as to allow them to be economically cast, and easily and speedily put together, and chiefly in a self-acting means of controlling the draft of the furnace, so regulating the heat as to insure economy, and dispense with the necessity of frequently meddling with the fire. The furnace has the usual grate bars and ash pit below, but the sides and top consist of water spaces cast in segments fitting into each other, and to be made air-tight by proper cement. The peculiar form of these segments can be best seen by inspection of the accompanying drawing, (Plate III.) The general figure is that of a small frustrum of a double pyramid, cast with projections on one face, and corresponding recesses in the other, so as to permit them to be tightly fitted together. At the upper part of each side, they communicate with the main tube for the hot water, and at the lower part with the return tube for the water, after it has made its circuit. The water flues, around which the air to be heated, circulates, are also cast in sections, called by Mr. Tasker manifolds, each section consisting of a number (in the model 7,) of tubes connected at the top and bottom by tubes of larger diameter. Each of these sections can be easily cast in one piece, and the number of joints to be kept close is thus much diminished. The ends of each connecting tube terminate in rings cast on them, which rings, when the sections are set up, fit into each other by projections and grooves, so as to form one continuous pipe, which is a continuation of one of the carrying or return water pipes of the furnace; and, when adjusted and cemented, a single bolt passing through the axis of each pipe, binds all the sections tightly together, yet allows them to be easily and rapidly separated.

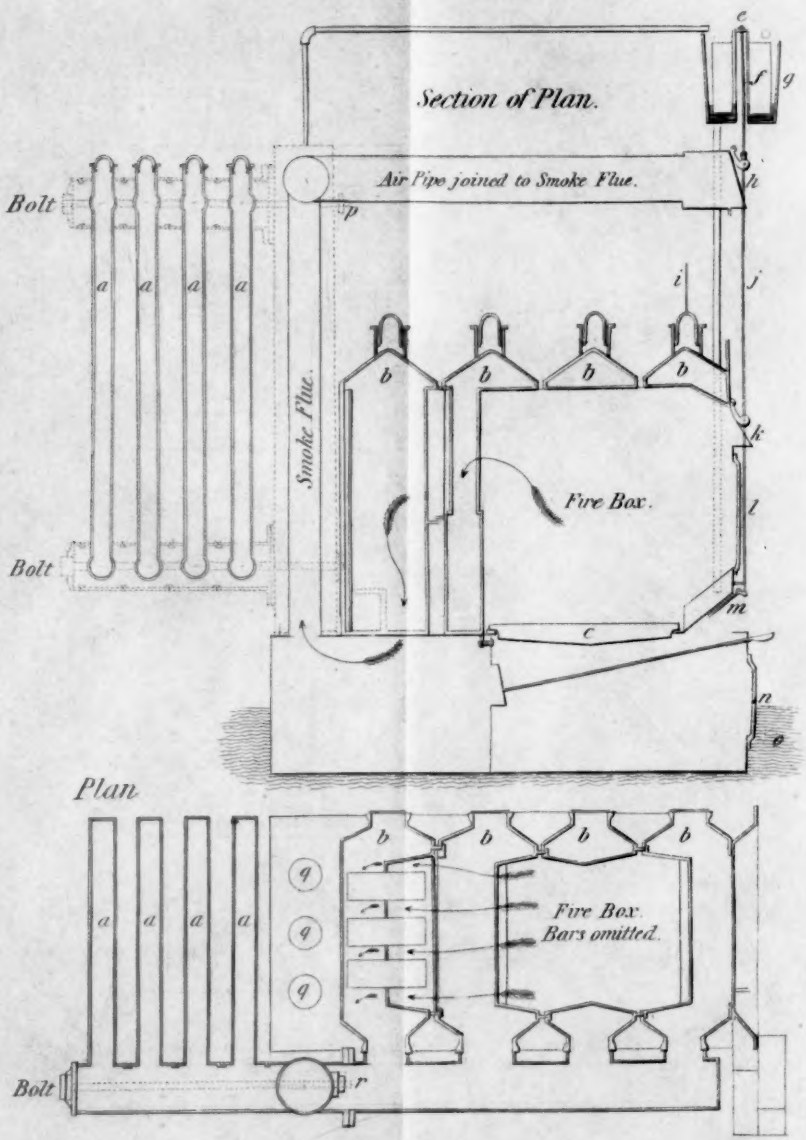
It need scarcely be remarked that, when it is desired, the water pipes may be continued throughout a building, so as to heat directly by the radiation from the water pipes.

But the principal feature of novelty about the apparatus is the self-governing valve. This consists of a float in a reservoir, so placed on the apparatus as to have the level of the water within it affected by the expansion of the water by heat, and its contraction as it cools. From this float a rod passes downwards and governs a register in a flue, by which, when open, air is admitted directly to the chimney. The draft door of the furnace is also closed by a register, so connected by a rod with that just described, that as the one opens, the other closes. So that as the water becomes too hot, its expansion lifts the float, and by its rod lessens the draft, both by letting the air directly into the chimney, and by tightly closing the draft door. The first register is, moreover, connected by means of a slotted rod, with another register in a flue admitting air to enter over the surface of the fire. Thus, when the cooling action begins, it is effected by the two flues first described, the last remaining inactive while the chimney register opens considerably, owing to the slot which allows the pin to rise without affecting the rod. But should the heat continue to increase so as to lift the chimney valve above a certain angle, the pin lifts the rod which operates on the last register, and the two thereafter lifting together, the temperature of the fire is speedily checked by the additional dampening of the draft through the fuel.

TASKER'S

Patent Self Regulating Hot Water Furnace.





The arrangements thus described are manifestly ingenious and simple, and they appear to the Committee, both from their own examination, and the testimony of gentlemen who have had them in operation on a large scale, to be practically useful. The Committee would especially notice the ingenious combinations for diminishing the number of joints, and rendering them easily and rapidly accessible, while the parts are so arranged as to allow them to be cast without difficulty.

The advantages claimed by Mr. Tasker for his apparatus are:

1st, A reliable method of controlling the fire without attention, for twelve hours or longer.

2d, A sufficient and uniform heat, without the possibility of producing a temperature injurious to the health, or unpleasant to the senses.

3d, The greatest economy in fuel and labor, the combustion being effectually regulated by the action of the water in the apparatus upon the valves, under and over the fire, and in the smoke flue.

4th, Safety from fire. The fire being entirely surrounded by water, circulating at a temperature below the boiling point.

5th, The improved method of combining the several parts, making but few joints, and these always accessible.

The apparatus is, of course, much more expensive at first, than an ordinary hot air furnace, but as it presents peculiar advantages, and is free from many disadvantages to which these are subject, every one must determine, in his own peculiar case, whether the increased regularity, safety, and economy of fuel and labor, will justify the additional expenditure.

REFERENCE TO PLATE III.

Front Elevation.

A, Valve opening smoke flue.
B, Mercury gauge.
C, Valve opening over fire.
D, Fire door.
E, Valve opening under fire.
F, Ash pit door.
G, Overflow pipe.
H, Rod connecting the float to all the valves.
I I, Valve rods.
J, Supply pipe.
K, Pipe connecting furnace to reservoir.
L, Reservoir—front left off.
M, Cellar floor.

PLAN.—*a a a a*, Radiating manifolds.
9 9 9, Smoke.
r, Bolt connecting manifold.
6 6 6 6, Cast iron tubular sections.

a a a a, Radiating manifolds.
b b b b, Cast iron tubular sections.
c, Fire bars.
d, Dust flue.
e, Rod connecting the float to all the valves.
f, Float.
g, Reservoir.
h, Valve opening into smoke flue.
i, Mercury gauge.
j, Valve rod.
k, Valve opening over fire.
l, Fire door.
m, Valve opening under fire.
n, Ash pit door.
o, Cellar floor.
p, Bolt passing through the several manifolds, by which all the joints are screwed up to tightness.

By order of the Committee,

WM. HAMILTON, *Actuary.*

Philadelphia, March 8th, 1855.

BIBLIOGRAPHICAL NOTICE.

Lowell Hydraulic Experiments, being a Selection from Experiments on Hydraulic Motors, on the Flow of Water over Weirs and in Canals of uniform Rectangular Section and of Short Length, made at Lowell, Massachusetts. By JAMES B. FRANCIS, Civ. Eng., &c.

The author of this work has had opportunities remarkably favorable for making experiments on a large scale through the liberality of the Manufacturing Companies of Lowell. No pains or expense appear to have been spared, and this work, embodying a part of the results, is a most valuable contribution to Hydraulic literature. The volume is a large quarto, well printed upon good paper, and fully illustrated by fifteen well executed folio plates, giving accurate drawings of the wheels submitted to experiment and of the apparatus used in making the investigations. The work is divided into two parts; the first is on hydraulic motors, and contains descriptions of the wheels upon which the experiments were made, tabulated results of the experiments, and practical instructions for proportioning Turbine water wheels. The second part treats of the flow of water over weirs, and on short rectangular canals, and gives an account of a series of experiments made upon a magnificent scale and with extreme precautions to insure accuracy.

The whole work is most creditable in every respect, and is commended to the notice of all interested in the science of hydraulics as a most valuable and important addition to this branch of knowledge. T.

The Quarterly Journal of Pure and Applied Mathematics, edited by J. J. SYLVESTER, M.A., F.R.S., and N. M. FERRES, M.A., assisted by G. G. STOKES, M.A., F.R.S., A. CAYLEY, M.A., F.R.S., and M. HERMITE. London: Published by J. W. PARKER & SON, West Strand, London.

The first number of a periodical bearing the above title, has reached us. It is (typographically) well got up, and from the character of the gentlemen who are associated in its editorial management, will, no doubt, prove a valuable exponent of the science on which it treats. M.

ERRATA.

Page	307	Equation	(18)	for	$y=2-4^{-1}b'$	read	$y=z-4^{-1}b'$.
"	"	"	(19)	"	$2^4+p\,2^2+q\,2$	"	$z+p\,z+q\,z=r$.
"	"	"	(20)	"	$2=s+t$	"	$z=s+t$
"	308	"	(22)	"	$3^2=-(t^2$ &c.	"	$s^2=-(t^2$ &c.
"	"	"	(23)	"	$s^4+3^2\,(6\,t^2$ &c.	"	$s^4+s^2\,(6\,t^2$ &c.
"	"	"	(28)	"	$u=2^1-3^{-1}m-$	"	$u=z'-3^{-1}m$
"	"	"	(29)	"	$2'^3+p'\,2'=r'$	"	$z'^3+p\,z'=r'$
"	"	"	(31)	"	$2'=s'+t'$	"	$z'=s'+t'$
"	309	line 18 and 14 from bottom, for 70, read >0.					
"	"	"	14 from bottom, for 7c read >0.				

INDEX.

LIST OF AMERICAN PATENTS, WITH REMARKS, &c.

October, 1854.

			PAGE.
32.	Improvement in Railroad Car Seats,	Charles P. Bailey,	16
33.	—— Making Hat Bodies,	Leander W. Boynton,	ib.
34.	—— Shingle Machine,	John A. Bradshaw,	ib.
35.	—— Spinning Rope and Cordage,	J. Carpenter,	17
36.	—— Rotary Pumps,	Stephen D. Carpenter,	ib.
37.	—— Turning Hubs, &c.,	S. Carpenter,	ib.
38.	—— Planing Machines,	John D. Dale,	ib.
39.	—— Rock Drill,	Edwin G. Dunham,	ib.
40.	—— Magnetic Alarm Bells,	Augustus Eckert,	ib.
41.	—— Sewing Pin,	Thaddeus Fowler,	18
42.	—— Sugar Making Apparatus,	Louis A. Gossin,	ib.
43.	—— Railroad Chair Machinery,	Benjamin F. Gossin,	ib.
44.	—— Construction of Ships,	John W. Griffith,	ib.
45.	—— Checking and Starting Cars,	Robert Grant,	ib.
46.	—— Neutralizing Chlorine,	Eben N. Horsford,	ib.
47.	—— Pawl Drills,	Simon Ingersoll,	ib.
48.	—— Saw Gummer,	John Jack,	19
49.	—— Cans for Liquids,	L. Jennings,	ib.
50.	—— Looms,	Stephen C. Mendenhall,	ib.
51.	—— Shingle Machine,	Elijah Morgan,	ib.
52.	—— Fastenings for Garments,	Richard Oliver,	ib.
53.	—— Splitting Horn, &c.,	Emerson Prescott,	ib.
54.	—— Damper for Ovens,	John P. Sherwood,	ib.
55.	—— Ginning and Cleaning Cotton,	C. Speer,	ib.
56.	—— Steam Engines,	Henry Tongue,	ib.
57.	—— Polishing Machine,	Henry Volkening,	ib.
58.	—— Turning Lathe,	Albin Warth,	ib.
59.	—— Locomotive Lamp,	Irvin A. Williams,	20
60.	—— Smut Machines,	Thomas B. Woodward,	ib.
61.	—— Construction of Sugar Boilers,	Edward J. Woolsey,	ib.
62.	—— Salt Manufacture,	S. B. Howd, ass'd to T. F. Davis, J. F. Leach, and R. F. Stevens,	ib.
63.	—— Looms for Pile Fabrics,	Erastus B. Bigelow,	ib.
64.	—— Power Looms,	Joseph T. Barnes,	ib.
65.	—— Trimming Hat Bodies,	Daniel Barnum,	21
66.	—— Water Metres,	Joseph D. Elliot,	ib.
67.	—— Smoke Consuming Stove,	E. A. Hill,	ib.
68.	—— Shoemakers' Edge Plane,	D. W. Horton,	ib.
69.	—— Iron Buildings,	Bernard J. La Mothe,	ib.
70.	—— Harvesters for Grain, &c.,	John H. Manny,	ib.
71.	—— Grinding Mills,	Charles Ross,	ib.
72.	—— Roving Tubes,	Moses Sargent, Jr.,	22
73.	—— Sawing Machine,	John J. Squire,	ib.
74.	—— Water Pipes,	Richard B. Stevenson,	ib.
75.	—— Enameling Iron,	C. F. Thornin & Charles Stumer,	ib.
76.	—— Toilet Glasses,	Henry Wayne,	ib.
77.	—— Brick Presses,	E. D. Williams and T. Tyrrell,	ib.
78.	—— Iron Bridge,	J. Yandell and Joseph H. Johnson,	ib.
79.	—— Vessels for Liquids,	J. H. Stimpson,	ib.
80.	—— Pen and Pencil Case,	John Richardson,	ib.
81.	—— Ploughs,	Henry F. Baker,	ib.
82.	—— Sifting and Bolting,	M. S. Bassett,	23

83.	Improvement in Smut Machines,	John D. Bedwell,	23
84.	—— Straw and Grain Separators,	Archibald Bowen,	ib.
85.	—— Softening Hemp and Flax,	Robert Boyack,	ib.
86.	—— Cleaning Cotton,	Samuel W. Brown,	ib.
87.	—— Chairs for Round Rails,	P. S. Devlan,	ib.
88.	—— Mill Brushes,	George L. Dulany,	ib.
89.	—— Seed Planters,	Absalom B. Earle,	ib.
90.	—— Granaries,	Ebenezer Ford,	ib.
91.	—— Stereotype Composition,	Julius Herrick,	24
92.	—— Bran Duster,	Joseph Johnston,	ib.
93.	—— Looms,	Barton H. Jenks,	ib.
94.	—— Making Carpets and Rugs,	John G. McNair,	ib.
95.	—— Fire Arms,	G. F. Palmié and A. H. Palmié,	ib.
96.	—— Pen Holder,	Myer Phineas,	ib.
97.	—— Polishing Paper,	Edward L. Perkins,	ib.
98.	—— Making Wrought Iron from Ore,	James Renton,	25
99.	—— Pen and Pencil Case,	John H. Rauch,	ib.
100.	—— Pen and Pencil Case,	John Richardson,	ib.
101.	—— Square, Scale, Level, and Bevel,	Josiah Shanklin,	ib.
102.	—— Safes,	Benjamin Sherwood,	ib.
103.	—— Fastening Lamps to Lanterns,	E. Sirret,	ib.
104.	—— Stoves,	Oron W. Wade,	ib.
105.	—— Mills,	William Warwick,	ib.
106.	—— Rotary Steam Engines,	B. H. Wright,	ib.
107.	—— Air Heating Furnaces,	W. Bryant, ass'd to J. B. Kelsey,	26
108.	—— Bearings for Loose Pulleys,	W. Campbell, ass'd to self & E. W. Shippen,	ib.
109.	—— Securing Lamps and Lanterns,	W. Porter, ass'd to J. N. Howe,	ib.
110.	—— Self-Acting Mules,	M. R. Pearson, ass'd to self and S. Shaw,	ib.
111.	—— Steam Engines,	Nathan Atherton,	ib.
112.	—— Key for Tuning Pianos,	A. Bassford,	ib.
113.	—— Printing in Colors,	A. M. and G. H. Babcock,	27
114.	—— Cutting Straps for Whips,	C. Baeder,	ib.
115.	—— Grain Winnowers,	Joseph Barker,	ib.
116.	—— Burglar's Alarm,	Ephraim Brown,	ib.
117.	—— Tempering and Flattening Saws,	William Clemson,	ib.
118.	—— Shingle Machine,	H. H. Evarts, ass'd to self and A. J. Brown,	ib.
119.	—— Burglar's Alarm,	Junius Foster,	ib.
120.	—— Filling Match Frames,	William Gates, Jr.,	28
121.	—— Picker Cylinders,	Robert Heneage,	ib.
122.	—— Fire Arms,	John C. Howe,	ib.
123.	—— Making Rope and Cordage,	J Harris, J. B. Scott, and G. Richmond,	ib.
124.	—— Seats for Wagons,	Chesley Jarnagin,	ib.
125.	—— Picking Cotton, &c.,	Richard Kitson,	ib.
126.	—— Tailors' Measures,	John M. Krider,	ib.
127.	—— Attachment to Siphon,	Samuel Lenher,	ib.
128.	—— Tailors' Measure,	W. and C. F. Lillibridge,	ib.
129.	—— Railroad Car Axles,	James E. M'Connell,	29
130.	—— Cartridges for Fire Arms,	Daniel Moore,	ib.
131.	—— Powder Flask for Guns,		
132.	—— Sawing Piles under Water,	Vincent Palen,	ib.
133.	—— Pen and Pencil Case,	John Richardson,	ib.
134.	—— Manufacture of Bricks,	L. E. Ransom,	ib.
135.	—— Manufacture of Mast Hoops,	E. W. Scott,	ib.
136.	—— Soldering Furnace,	William J. Stevenson,	ib.
137.	—— Odometers,	Samuel R. Thorp,	ib.
138.	—— Odometers,	Julius Thompson,	ib.
139.	—— Grate Bars,	Samuel Vansyckel,	30
140.	—— Spark Arresters,	R. A. Wilder,	ib.
141.	—— Water Metre,	S. R. Wilmot,	ib.
142.	—— Cutting Rags for Paper,	A. S. Woodward and B. F. Bartlett,	ib.
143.	—— Surface Condenser,	William Sewell,	ib.

ADDITIONAL IMPROVEMENTS.

1. Improvement in Polishing Raw Hide Whips,	Charles Baeder,	30
2. —— Whiffle Tree Hooks,	M. Newman, N. C. Whitcomb, & G. C. Cole,	ib.
3. —— Washer for Axle Wheels,	William Thornley,	ib.

RE-ISSUES.

1. Improvement in Sewing Machines,	Isaac M. Singer,	31
2. —— Fire Arms,	H. Smith and D. B. Wesson,	ib.
3. —— Caloriferes,	Samuel Whitmarsh,	ib.
4. —— Smut Machines,	John Hollingsworth,	ib.
5. —— Rakes for Grain Harvesters,	Jearum Atkins,	ib.

DESIGNS.

1. For Franklin Stoves,	William Reser,	32
2. —— Clock Case Fronts,	Charles Chinnock,	ib.
3. —— Clock Case Fronts,		
4. —— Clock Case Fronts,		
5. —— Franklin Stoves,	William Reser,	ib.
6. —— Cooking Stove,	W. P. Gray, ass'd to Cox, Hager & Cox,	ib.
7. —— Franklin Fire Place,	N. S. Prince, ass'd to Franklin, Muzzy & Co., and A. Lambard,	ib.
8. —— Brackets,	Isaac De Gouche,	ib.

November, 1854.

1. Improvement in Sewing Machines,	Daniel C. Amber,	32
2. —— Locks,	John B. Brennan,	ib.
3. —— Polishing Stone,	Albert Broughton,	ib.
4. —— Trap for Animals,	Robert S. Craig,	ib.
5. —— Joint in Water Wheels,	Reuben Daniels,	ib.
6. —— Stone Drilling,	F. Davison,	33
7. —— Glass Furnaces,	Jacob Green,	ib.
8. —— Corn Shellers,	Samuel Gumaer,	ib.
9. —— Making Buckles,	Sheldon S. Hartshorne,	ib.
10. —— Glass Furnaces,	A. K. Hay,	ib.
11. —— Barrel Machinery,	Horace S. Higgens,	ib.
12. —— Bottle Stoppers,	T. Kendall,	ib.
13. —— Furnace for Heating,	Joseph Leeds,	ib.
14. —— Vulcanizing Elastic Gums,	E. E. Marcy,	ib.
15. —— Coal Hods,	William N. Martin,	ib.
16. —— Potato Diggers,	Ives W. McGaffey,	34
17. —— Sawing Bolts for Staves,	B. McKeage,	ib.
18. —— Bombs, Shells, &c.,	E. T. Miller,	ib.
19. —— Leather Banding,	George Miller,	ib.
20. —— Slate Frame,	Edmund Morris,	ib.
21. —— Railroad Car Brakes,	M. P. Norton,	ib.
22. —— Farm Gate,	Dewey Phillips,	ib.
23. —— Desulphurizing Elastic Gums,	W. E. Rider and J. Murphy,	ib.
24. —— Cutting Tenons on Slats,	E. W. Roff,	ib.
25. —— Steam Engine Valve,	C. Rumley,	ib.
26. —— Rotary Engine,		
27. —— Making Hat Bodies,	Isaac Searls,	35
28. —— Harness Saddles,	Robert M. Selleck,	ib.
29. —— Operating Circular Saws,	James Slater,	ib.
30. —— Corn Shellers,	J. P. Smith,	ib.
31. —— Blast in Furnaces,	B. H. Washington,	ib.
32. —— Shovel Handles,	Elbridge Webber,	ib.
33. —— Locks,	Charles Wilson,	ib.
34. —— Fire Arms,	Wendell Wright,	ib.
35. —— Loom Beams,	S. T. Thomas and E. A. Everett,	ib.
36. —— Carriage Lifting Jack,	J. Jenkins, ass'd to Roe, Horton, & Co.,	ib.
37. —— Dressing Stone,	J. P. Avery, ass'd to J. B. Bromley,	36
38. —— Carving Stone,	Edwin Allen,	92

39.	Improvement in Smut Machines,	Levi B. Ball,	93
40.	—— Cultivators,	William Bancroft,	ib.
41.	—— Valves for Exhaust Steam,	Henry Bates,	ib.
42.	—— Hot Water Apparatus,	William Beebe,	ib.
43.	—— Iron direct from the Ore,	Martin Bell and Edward B. Isett,	ib.
44.	—— Lamp Caps,	William Bell,	ib.
45.	—— Cultivators,	Job Brown,	ib.
46.	—— Adjusting Mill Saws,	T. M. Chapman,	ib.
47.	—— Multigardo Iron Fence,	Matthias P. Coons,	ib.
48.	—— Vessels in Sectional, Dry and Railway Docks,	Horace J. Crandell,	ib.
49.	—— Looms for Figured Fabrics,	George Crompton,	94
50.	—— Sewing Machines,	D. Harris, ass'd to J. P. Bowker,	ib.
51.	—— Ploughs,	Jonathan Hibbs,	ib.
52.	—— Paging Machines,	George Hodgkinson,	ib.
53.	—— Self-Acting Car Brakes,	George T. Leach,	ib.
54.	—— Breech Loading Fire Arms,	F. Maton,	ib.
55.	—— Omnibus Registers,	William Morris,	ib.
56.	—— Railroad Car Coupling,	Joseph Miller,	ib.
57.	—— Grain Winnowers,	William Moore,	ib.
58.	—— Tape Worm Trap,	Alpheus Myers,	95
59.	—— Tape Worm Operation,		
60.	—— Saw Mills,	C. B. Normand,	ib.
61.	—— Hanging Mill Saws,		
62.	—— Curved and Bevel Sawing,		
63.	—— India Rubber Overshoes,	J. A. Pease,	ib.
64.	—— Excavator and Ditching Plough,	Charles A. Robbins,	ib.
65.	—— Excavating Machine,	George D. Stillson,	ib.
66.	—— Shingle Machine,	William Stoddard,	96
67.	—— Grain and Grass Harvesters,	J. Swartz,	ib.
68.	—— Stretching and Drying Cloth,	Benjamin J. Tayman,	ib.
69.	—— Saw Gauge,	Orson Westgate,	ib.
70.	—— Making Printing Blocks,	Leon Jarosson,	ib.
71.	—— Casting Type,	George Bruce,	ib.
72.	—— Pattern Chains for Looms,	George Crompton and M. A. Furbush,	ib.
73.	—— Canal Boat Tow Lines,	J. W. Caldwell,	97
74.	—— Lubricating Steam Engines,	John Absterdam,	ib.
75.	—— Hand Brick Mould,	Clark Alvord,	ib.
76.	—— Papering Walls,	Henry F. Baker,	ib.
77.	—— Sauce Pans,	Henry F. David,	ib.
78.	—— Closing Sheet Metal Boxes,	Charles G. Everitt,	ib.
79.	—— Locomotive Engine Valve Gear,	James Freeland,	ib.
80.	—— Cleaning Cards for Carding,	Samuel Greene,	ib.
81.	—— Shingle Machine,	Adoniram Kendall,	ib.
82.	—— Calcining Plaster of Paris,	Jerome B. King,	98
83.	—— Seed Planters,	George W. Lee,	ib.
84.	—— Slide Valves in Steam Engines,	Daniel B. Martin,	ib.
85.	—— Life Preservers,	Richard L. Nelson,	ib.
86.	—— Pencils for Drawing,	Mighill Nutting,	ib.
87.	—— Sewing Machines,	C. Parham,	ib.
88.	—— Spinning Frames,	William Perry,	ib.
89.	—— Making Wire Ropes,	J. A. Roebling,	ib.
90.	—— Threading Screw Blanks,	Elliot Savage,	99
91.	—— Furnaces,	J. L. Stevens,	ib.
92.	—— Inhaling Apparatus,	S. H. T. Tilghman,	ib.
93.	—— Clothes Clamp,	William H. Towers,	ib.
94.	—— Dressing Mill Stones,	T. W. Trussel,	ib.
95.	—— Lamps,	Isaac Van Bunschoten,	ib.
96.	—— Seed Planters,	Milan Waterbury,	ib.
97.	—— Hemp Rotting,	William Watt,	ib.
98.	—— Surgical Forceps,	J. G. Loomis, ass'd to W. A. Gardiner,	ib.
99.	—— Scythe Fastenings,	T. C Ball, ass'd to N. Dawson,	ib.

100. Improvement in Planing Machines,	H. Snow, ass'd to J. A. Woodbury,	100
101. —— Drying Clothes,	S. Woodward, ass'd to self, J. P. Nelson, and A. C. Carroll,	ib.
102. —— Hay and Cotton Press,	Alders Adams,	ib.
103. —— Power to Fire Engines,	G. Backstein,	ib.
104. —— Towel and Clothes Horse,	John Cram,	ib.
105. —— Clover Hullers,	A. B. Crawford,	ib.
106. —— Seats for Public Buildings,	A. Eliaers,	ib.
107. —— Feathering Paddle Wheels,	F. Felter,	ib.
108. —— Converting Reciprocating into Rotary Motion,	C. B. Gallagher,	ib.
109. —— Rotary Cooking Stove,	Elias A. Hibbard,	ib.
110. —— Knitting Machines,	J. Hollen,	ib.
111. —— Pressing Bonnet Fronts,	Whitten E. Kidd,	101
112. —— Steam Boilers,	Daniel B. Martin,	ib.
113. —— Tanks and Cisterns for supplying Locomotives,	A. W. McDonald,	ib.
114. —— Stoves,	Jordan L. Mott,	ib.
115. —— Making Metal Rods and Tubes,	James Newman,	ib.
116. —— Breech Loading Fire Arms,	A. D. Perry,	ib.
117. —— Making Cylinder Fire Arms,	E. K. Root,	ib.
118. —— Piano Forte Action,	Daniel H. Shirley,	102
119. —— Pressing Bonnet Frames,	Nathaniel Spence,	ib.
120. —— Looms for Weaving Bags,	William Talbot,	ib.
121. —— Mitre Box,	William Tinsley,	ib.
122. —— Inclined Sliding Valve,	Edward H. Tracy,	ib.
123. —— Rotary Lathe,	George Tugnot,	ib.
124. —— Planing Machine,	Daniel Van Fleet,	ib.
125. —— Metal Drills,	William Wakely,	ib.
126. —— Sewing Machines,	T. E. Weed,	ib.
127. —— Washing Machines,	William Wheeler,	103
128. —— Windlasses,	H. Richards and C. F. Windsor,	ib.
129. —— Sewing Machines,	O. G. Boynton, ass'd to N. Hunt,	ib.
130. —— Sewing Machines,	T. J. W. Robertson, ass'd to E. A. Beach,	ib.
131. —— Making Rope and Cordage,	A. Woodworth and G. Chamberlin,	ib.

ADDITIONAL IMPROVEMENT.

1. Improvement in Reed Musical Instruments,	F. A. Gleason,	103

RE-ISSUES.

1. Improvement in Winnowing Machines,	Samuel Canby,	103
2. —— Rake to Harvesting Machines,	Sylvanus Miller,	104

DESIGNS.

1. For Bar Room Stove,	J. Beesley ass'd to W. P. Cresson & Co	104
2. —— Egg Stove,	D. Stuart Do. Do.	ib.
3. —— Wire Fences,	Matthias Lachenmaier,	ib.
4. —— Stoves,	Horace W. Robbins,	ib.

December, 1854.

1. Improvement in Seats for Public Buildings,	A. H. Allen,	104
2. —— Oven for Baking,	G. S. Blodgett and P. T. Sweet,	ib.
3. —— Steam Boiler Alarm,	Patrick Clark,	ib.
4. —— Reefing Topsails,	H. J. Crandall,	ib.
5. —— Steering Apparatus,	Joseph D. Crowell,	105
6. —— Rotary Pumps,	Joshua Gray,	ib.
7. —— Railroad Car Seats,	John T. Hammit,	ib.
8. —— Railroad Switches,	Samuel P. Kittle,	ib.
9. —— Separating Fibre of Tropical Plants,	John Lilley,	ib.
10. —— Book Binding	Leonard F. Markham,	ib.
11. —— Paper Making Machines,	Obadiah Marland	ib.
12. —— Paper Making Machines,	Obadiah Marland,	ib.

13.	Improvement in Wash Stands,	W. H. Miller,	105
14.	—— Shelling and Grinding Corn,	Henry R. Miller,	106
15.	—— Crushing Ores,	William H. Plumb,	ib.
16.	—— Steam Boilers,	John A. Roebling,	ib.
17.	—— Railroad Car Brakes,	Michael Shimer,	ib.
18.	—— Dry Docks,	James E. Simpson,	ib.
19.	—— Casting Metal Window Sashes,	T. J. Sloan,	ib.
20.	—— Railroad Cars,	David G. Smith,	ib.
21.	—— Making Brushes,	M. Stewart,	ib.
22.	—— Extinguishing Fires,	Amasa Stone,	ib.
23.	—— Hot Water Furnaces,	Thomas T. Tasker,	107
24.	—— Covering Cotton Thread with Wool,	James Taylor,	ib.
25.	—— Lanterns,	William D. Titus,	ib.
26.	—— Hydraulic Rams,	Ellis Webb,	ib.
27.	—— Churns,	Elbridge Webber,	ib.
28.	—— Grain and Grass Harvesters,	Cyrenus Wheeler, Jr.,	ib.
29.	—— Dry Gas Metres,	F. Darracott, ass'd to G. Darracott,	ib.
30.	—— Knitting Machines,	J. Pepper, Jr., ass'd to the Franklin Mills,	ib.
31.	—— Lubricating Apparatus,	J. Regester, ass'd to self, and E. Clampitt,	108
32.	—— Quartz Crushers,	J. W. Cochran,	ib.
33.	—— Polygraphs,	Nathan Ames,	ib.
34.	—— Polygraphs,	Nathan Ames,	ib.
35.	—— Operating Looms by Electricity,	Gaetan Bonelli,	ib.
36.	—— Hanging Carriage Bodies,	B. F. Brown,	ib.
37.	—— Oscillating Steam Engines,	M. Cridge and S. Wadsworth,	109
38.	—— Bending Metals,	William W. Cumberland,	ib.
39.	—— Crushing, &c., Minerals, &c.,	T. O. Cutler,	110
40.	—— Throstles for Spinning,	Charles Danforth,	ib.
41.	—— Destroying Vermin,	G. W. French and W. Wagstaff,	ib.
42.	—— Hoes,	Moses Gates,	ib.
43.	—— Coffins,	John Good,	ib.
44.	—— Harrows,	E. L. Hager,	ib.
45.	—— Angler's Float and Sink,	J. W. Hoard,	ib.
46.	—— Securing Carpets to Floors,	E. Jackson,	ib.
47.	—— Carriage Hub Bands,	J. Jenkins and J. R. Cooke,	ib.
48.	—— Flyers,	Edward C. Johnson,	ib.
49.	—— Regulators for Steam Engines,	H. A. Luttgens,	111
50.	—— Sawing Light Lumber,	John F. Lovecraft,	ib.
51.	—— Sewing Machines,	William Lyon,	ib.
52.	—— Propelling Vessels,	Henry H. Olds,	ib.
53.	—— Dock Holders for Horses,	Eldridge H. Penfield,	ib.
54.	—— Gold Collector,	James Perry,	ib.
55.	—— Cheese Vats,	Henry A. Roe,	112
56.	—— Regulator for Hot Water Apparatus,	J. H. Ross,	ib.
57.	—— Looms,	George Roth,	ib.
58.	—— Rattan Machine,	Sylvanus Sawyer	ib.
59.	—— Sewing Machine,	George W. Stedman,	ib.
60.	—— Planters and Cultivators,	D. W. Shares,	ib.
61.	—— Scraping Metals,	J. Stever,	ib.
62.	—— Treating Mother Water of Salines,	Edward Stieren,	ib.
63.	—— Boring Machine,	Benjamin F. Taft,	ib.
64.	—— Steam Engine Condensers,	H. Waterman,	113
65.	—— Hot Air Furnaces,	Daniel P. Weeks,	ib.
66.	—— Door Locks,	Jacob Weimar,	ib.
67.	—— Dressing Felloes,	Charles W. Wyatt,	ib.
68.	—— Ships' Windlasses,	David L. Winsor,	ib.
69.	—— Seed Planters,	J. Andrews, ass'd to self, Richardson and G. Symmes,	ib.
70.	—— Water Proofing Cloth,	M. J. Lieberman,	ib.
71.	—— Casting Spouts of Tea Pots,	H. Tiebe and W. Muhle,	ib.

72. Improvement in Trussing Yards of Vessels,	J. Perkins, ass'd to self and H. P. Upton,	114
73. —— Cutting Irregular Forms,	Charles P. Bailey,	165
74. —— Condensers,	Samuel W. Brown,	ib.
75. —— Metal Separators,	Thomas J. Chubb,	ib.
76. —— Cleaning Seed Cotton, &c.,	Major B. Clark,	ib.
77. —— Double Acting Force Pump,	D. W. Clark and S. H. Gray,	ib.
78. —— Supporters for Docking Vessels,	Horace J. Crandell,	ib.
79. —— Guards for Ferry Boats,	D. Fitzgerald, T. Rogers, W. C. Walker,	166
80. —— Clover Harvesters,	John S. Gage,	ib.
81. —— Grain Mills,	G. W. Grader and B. F. Cowan,	ib.
82. —— Water Wheels,	Stephen Hadley, Jr.,	ib.
83. —— Straightening Metal Bars,	Isaac B. Howe,	ib.
84. —— Dynamometers,	W. B. Leonard,	ib.
85. —— Sash Fasteners,	Charles Merrill,	ib.
86. —— Making Sugar Moulds,	James Myers, Jr.,	ib.
87. —— Composition for Tanning,	G. Reynolds,	ib.
88. —— Cut Nail Machine,	J. P. Sherwood,	ib.
89. —— Holding Vessels in Dry Docks,	Jonathan Smith,	167
90. —— Shingle Machines,	J. J. Speed, Jr., and J. A. Bailey,	ib.
91. —— Revolving Fans,	L. Stein,	ib.
92. —— Packing Flour,	Samuel Taggart,	ib.
93. —— Life Preserving Seats,	Nathan Thompson, Jr.,	ib.
94. —— Boot Crimping,	Gray Utley,	ib.
95. —— Oven Cooking Range,	Daniel P. Weeks,	ib.
96. —— Spring Bed Bottoms,	Wendall Wright,	ib.
97. —— Forging Horse Shoes,	R. Griffith and G. Shields,	168
98. —— Grain and Grass Harvesters,	W. F. Ketchum, ass'd to R. L. Howard,	ib.
99. —— Splitting Leather,	E. Pratt, ass'd to self, and H. P. Upton,	ib.
100. —— Turning Prismatic Forms,	M. Roberts, ass'd to self, & H.E. Pierce,	ib.
101. —— Sewing Machines,	A.B.Wilson, ass'd to W.P.N. Fitzgerald,	ib.

RE-ISSUE.

1. Improvement in Seed Planters,	Moses and Samuel Pennock,	168

DESIGN.

1. For Box Stoves,	J. Stewart, as'd to Cresson, Stewart & Peterson,	169

January, 1855.

1. Improvement in Boring, Planing, &c., Metals,	N. Aylesworth,	169
2. —— Feeding Paper to Presses, &c.,	David Baldwin,	ib.
3. —— Constructing Vessels,	William Ballard,	ib.
4. —— Looms,	Abram Brigham,	ib.
5. —— Grain and Grass Harvesters,	J. E. Brown and S. S. Bartlett,	ib.
6. —— Dove-Tailing Machines,	Thomas H. Burley,	ib.
7. —— Grain and Grass Harvesters,	M. Burnett and C. Vander Woerd,	ib.
8. —— Locks for Fire Arms,	J. S. Butterfield,	ib
9. —— Trap for Animals,	J. Caffrey,	170
10. —— Driving Circular Saws,	Thomas J. Flanders,	ib.
11. —— Churns,	Ezekiel Gore,	ib.
12. —— Cutting Boot and Shoe Soles,	J. W. Hatch and H. Churchill,	ib.
13. —— Balances for Time Keepers,	C. W. Hawkes and G. P. Reed,	ib.
14. —— Atmospheric Pile Driving,	Alexander Holstrom,	ib.
15. —— Making Railroad Chairs,	J. B. Harris,	ib.
16. —— Cotton Gins,	Asa P. Keith,	ib.
17. —— Flanches on Iron Beams,	Julius H. Kroehl,	171
18. —— Tonguing and Grooving,	Hazard Knowles,	ib.
19. —— Forging Car Wheels,	Wesley M. Lee,	ib.
20. —— Constructing Pavements,	Jean Francois Le Moulnier,	ib.
21. —— Shingle Machine,	Adrian V. B. Orr,	ib.
22. —— Regulating Size of Rovings,	S. Pearson, Jr., and W H. Gardner,	ib.
23. —— Extracting Tannin from Leather,	Obadiah Rich,	ib.

24.	Improvement in Signal Flags,	Henry J. Rogers,	171
25.	—— Splitting Rattans,	S. Sawyer,	ib.
26.	—— Making Soap,	Richard A. Tilghman,	ib.
27.	—— Life Preserving Raft,	F. Z. Tucker,	ib.
28.	—— Making India Rubber Cloth,	H. G. Tyer and John Helm,	172
29.	—— Sheet Iron Blinds,	William E. Ward,	ib.
30.	—— Sewing Machines,	Daniel J. Ward,	ib.
31.	—— Protecting Slides & Ways from Dust,	E. H. Foote,	ib.
32.	—— Tanning Processes,	R. Keeler, ass'd to L. C. England,	ib.
33.	—— Making Wooden Boxes,	L. Koch, ass'd to T. Rincus,	ib.
34.	—— Curtain Fixtures,	P. H. Niles, ass'd to self and J. A. Richards,	ib.
35.	—— Unhairing Hides,	A. H. Ward, Jr. ass'd to self & K. Boolt,	ib.
36.	—— Seed Planters,	Alexander Anderson,	ib.
37.	—— Self-Sealing Preserve Cans,	R. Arthur,	ib.
38.	—— Carriage Journal Boxes,	S. B. Batchelder,	173
39.	—— Suspended Purchases,	William H. Brown,	ib.
40.	—— Teeth,	Sharpless Clayton,	ib.
41.	—— Stereotyping,	Willard Cowles,	ib.
42.	—— Ox Yokes,	Levi Dederick,	ib.
43.	—— Composition for Fuel,	St. John O'Doris,	ib.
44.	—— Fermenting Beer Tuns,	Adolph Hammer,	ib.
45.	—— Fire-proof Iron Buildings,	Emanuel Harmon,	ib.
46.	—— Planing Machines,	M. G. Hubbard,	ib.
47.	—— Cultivators,	John Imel,	174
48.	—— Cutting and Turning Slate,	Asa Keyes,	ib.
49.	—— Blowing Blasts, &c.,	P. W. Mackenzie,	ib.
50.	—— Railroad Car Brakes,	Henry Miller,	ib.
51.	—— Fruit Dryers,	R. S. Morse,	ib.
52.	—— Elevating Scaffolds,	F. Rudolph,	ib.
53.	—— Rakes,	Emile Sirret,	ib.
54.	—— Hanging Saws,	John A. Taplin,	ib.
55.	—— Dressing Leather,	Cuno Werner,	ib.
56.	—— Cast Iron Pavements,	C. Warner,	ib.
57.	—— Hats,	William F. Warburton,	ib.
58.	—— Cutting Irregular Forms,	Warren Wadleigh,	175
59.	—— Making Weavers' Harness,	J. S. Winsor,	ib.
60.	—— Sawing Machine,	Lysander Wright,	ib.
61.	—— Burglar's Alarm,	Daniel Wells,	ib.
62.	—— Printing Different Colors,	S. Brown,	ib.
63.	—— Steam Engines,	W. S. Burgess,	ib.
64.	—— Turning Cylinders,	P. S. Cahoon & S. F. Ross,	ib.
65.	—— Grinding Mills,	Amory Felton,	176
66.	—— Paint Brush,	William Hicks,	ib.
67.	—— Printing Press,	Sidney Kelsey,	ib.
68.	—— Folding Life Boats,	C. Locher,	ib.
69.	—— Printing Press,	James Lewis,	ib.
70.	—— Padlocks,	Thomas Slaught,	ib.
71.	—— Steam Engines,	J. Smith,	ib.
72.	—— Brace for Piano Frames,	D. Gibbons, ass'd to F. Starr,	ib.
73.	—— Repeating Fire Arms,	J. Stevens, ass'd to Mass. Arms Co.,	ib.
74.	—— Propeller,	Charles De Bergue,	177
75.	—— Crushing, &c., Ores,	Arnold Buffum,	ib.
76.	—— Turning Irregular Forms,	William J. Casselman,	ib.
77.	—— Candle Moulds,	L. C. Ashley,	ib.
78.	—— Making Nuts and Washers,	Robert Brayton,	ib.
79.	—— Stop Cock,	David A. B. Coffin,	ib.
80.	—— Pendulum for Time Pieces,	Aaron D. Crane,	ib.
81.	—— Driving Circular Saws,	William B. Emery,	ib.
82.	—— Ratchet Wrenches,	C. G. Everett,	178
83.	—— Forcing Pump,	Gilbert G. Farnum,	ib.

84.	Improvement in Entry Lights,	Charles W. Felt,	178
85.	—— Dredging Machines,	D. S. Howard,	ib.
86.	—— Stoppers of Bottles,	J. Hanley,	ib.
87.	—— Steam Engines,	G. W. Hubbard & W. E. Conant,	ib.
88.	—— Hop Extracting,	A. Hammer,	179
89.	—— Mash Machines,	A. Hammer,	ib.
90.	—— Rotary Shingle Machine,	J. W. Hatcher,	ib.
91.	—— Steam Engines,	William C. Hicks,	ib.
92.	—— Wind-Mill,	Frank G. Johnson,	ib.
93.	—— Coke Ovens,	Guillaume Lambert,	ib.
94.	—— Refrigerators,	Hugh L. McAvoy,	ib.
95.	—— Planing and Matching Machines,	C. B. Morse,	ib.
96.	—— Re-working India Rubber,	Charles Morey,	ib.
97.	—— Printing from Engraved Plates,	Robert Neale,	ib.
98.	—— Windlasses,	Olden Nichols,	180
99.	—— Grain Harvesters,	J. E. Newcomb,	ib.
100.	—— Oscillating Engines,	John A. Reed,	ib.
101.	—— Kneading Dough,	John Louis Rolland,	ib.
102.	—— Carriage Cramps,	Samuel P. Sanford,	ib.
103.	—— Soldering Tin Cans,	William J. Stevenson,	ib.
104.	—— Life Preserving Seats,	N. Thompson,	ib.
105.	—— Stave Jointer,	James W. Treadway,	ib.
106.	—— Beef Spreader,	Frederick Tesh,	ib.
107.	—— Flouring Mills,	John L. Yule,	ib.
108.	—— Turning Fancy Handles, &c.,	L. Wentworth,	181
109.	—— Looms,	Joseph Welsh,	ib.
110.	—— Japanned Leather,	H. L. Hall, ass'd to J. C. Stimpson,	ib.
111.	—— Forming Kettles from Disks,	L. C. Camp, ass'd to Phelps, Dodge & Co.,	ib.
112.	—— Making Metal Tubes,	W. Beasley, ass'd to self, J. & W. Brett, & C. W. Tupper,	ib.
113.	—— Looms,	W. Tongue, ass'd to self & J. Buckley,	ib.
114.	—— Fire Arms,	Thomas H. Barlow,	ib.
115.	—— Seed Planters,	Jarvis Case,	ib.
116.	—— Water Metre,	John S. Barden,	182
117.	—— Sewing Machines,	Jotham F. Conant,	ib.
118.	—— Bench Plane,	William C. Hopper,	ib.
119.	—— Fire Arms,	Edmund H. Graham,	ib.
120.	—— Temples for Looms,	John H. Allen,	ib.
121.	—— Gold Washer and Amalgamator,	J. S. Addison,	ib.
122.	—— Lubricating Axles,	Alfred C. Garrett,	ib.
123.	—— Lamp Shades,	M. B. Dyott,	ib.
124.	—— Door Latch Locks,	John C. Kline,	ib.
125.	—— Ploughs,	Arnton Smith,	183
126.	—— Lime Kilns,	Samuel H. Robinson,	ib.
127.	—— Moulding Machines,	George M. Ramsey,	ib.
128.	—— Fire Arms,	Alonzo D. Perry,	ib.
129.	—— Brakes for Railroad Cars,	Lucius Paige,	ib.
130.	—— Scales,	John L. McPherson,	ib.
131.	—— Sewing Machines,	H. B. Smith,	ib.
132.	—— Moulding Machine,	C. B. Morse,	ib.
133.	—— Spring Balances,	E. P. Beckwith,	184
134.	—— Steering Apparatus,	Abijah R. Tewksbury,	ib.
135.	—— Hand Truck,	Parley Hutchings,	ib.
136.	—— Grain and Grass Harvesters,	O. B. Judd,	ib.
137.	—— Straw Cutters,	John A. Pitts,	ib.
138.	—— Making Boxes of Paper,	R. L. Hawes,	ib.
139.	—— Seed Planters,	Elijah Morgan,	185
140.	—— Stereoscopic Medallion,	John F. Mascher,	ib.
141.	—— Casting Projectiles,	Hezekiah Conant,	ib.
142.	—— Lubricator for Steam Engines,	John Sutton,	ib.
143.	—— Seed Planters,	S. L. Stockstill & P. H. Humes,	ib.

144.	Improvement in Preventing Incrustations in Steam Boilers,	Gustavus Weissenborn,	186
145.	—— Dies for Bolts,	J. T. Willinarth,	ib.
146.	—— Pipes for Steam Brakes,	W. Wright,	ib.
147.	—— Building Block,	J. A. Messenger, ass'd to A. Foster,	ib.
148.	—— Door Knobs,	W. Leighton, ass'd to N. E. Glass Co.,	ib.
149.	—— Hernial Truss,	William M. Bonwill,	ib.
150.	—— Gas Heater,	William F. Shaw,	ib.
151.	—— Corrugating Sheet Metal,	Solomon G. Booth,	ib.
152.	—— Hay Making Machine,	George A. Brown,	ib.
153.	—— Cutting Out Stone,	H. J. Brunner,	ib.
154.	—— Curtain Rollers,	D. H. Chamberlain & J. Hartshorn,	187
155.	—— Carriages,	George R. Comstock,	ib.
156.	—— Carriage Seats,		
157.	—— Looms,	James Eccles,	ib.
158.	—— Holding Window Blinds,	Henry A. Frost,	ib.
159.	—— Marquetry,	Louis Francis Groebl,	ib.
160.	—— Hot-Air Furnaces,	Michael Greenebaum,	ib.
161.	—— Cutting and Grinding Vegetables,	William H. Harn,	ib.
162.	—— Book Brace,	William Ives,	ib.
163.	—— Lifting Jacks,	Samuel G. Jones,	188
164.	—— Rolling Iron Shutters,	Charles Mettam,	ib.
165.	—— Metal Folding Machines,	D. Newton,	ib.
166.	—— Washing Paper Stock,	H. W. Peaslee,	ib.
167.	—— Fire Engines,	Albert W. Roberts,	ib.
168.	—— Compound Rifle Machine,	E. K. Root,	ib.
169.	—— Supplying Metal to Furnaces,	Eloy Schmitz,	ib.
170.	—— Mortising Machines,	R. P. Benton,	189
171.	—— Compound Crowbar,	Isaac J. Cole,	ib.
172.	—— Fastening Centre Bits,	Abel W. Streeter,	ib.
173.	—— Lubricating Steam Machinery,	John Sutton,	ib.
174.	—— Lanterns,	Lewis Hover,	ib.
175.	—— Iron Window Blinds,	Henry Blakely,	ib.
176.	—— Looms,	George Copeland,	ib.
177.	—— Cotton Seed Planter,	I. Williams & I. W. Bausman,	190
178.	—— Repeating Cannon,	S. Huffman, ass'd to self & D. O. Hare,	ib.
179.	—— Buckets for Chain Pumps,	E. Morris,	ib.
180.	—— Match Machine,	Leopold & Joseph Thomas,	ib.
181.	—— Paddle Wheels,	J. U. Wallis,	ib.
182.	—— Oscillating Engines,	G. F. Wood,	ib.
183.	—— Hand Rails for Stairs,	J. M. Bull,	ib.
184.	—— Fountain Pens,	Newell A. Prince,	ib.
185.	—— Boring Wells,	I. J. W. Adams,	234
186.	—— Clarifying Glue,	William Adamson,	ib.
187.	—— Hot Air Furnaces,	Abel H. Bartlett,	ib.
188.	—— Car Ventilator,	B. T. Babbitt,	ib.
189.	—— Seed Planters,	John Blackwood,	ib.
190.	—— Seed Planters,	Job Brown,	ib.
191.	—— Fountain Brush,	D. H. Chamberlain & J. Hartshorn,	ib.
192.	—— Ploughs,	Alfred Doe,	ib.
193.	—— Cop Tube Machines,	James Eaton,	235
194.	—— Double Acting Force Pumps,	George Fowler,	ib.
195.	—— Yoke of Shirts,	Hezekiah Griswold,	ib.
196.	—— Clover Hullers,	Jonathan Hibbs,	ib.
197.	—— Piano Fortes,	Alexander Hall,	ib.
198.	—— Rain Staff Screws for Ship Carpenters,	John Hobbs,	ib.
199.	—— Carriage Wheels,	W. Race & B. Holly,	ib.
200.	—— Augers,	Russell Jennings,	ib.
201.	—— Door Latches,	William H. McNamee,	ib.
202.	—— Felting Hat Bodies,	S. S. Middlebrook & J. B. & C. F. Blakeslee,	ib.
203.	—— Sewing Machines,	John B. Nichols,	236

204.	Improvement in Grass Harvesters,	A. Palmer,	236
205.	—— Lantern Frames,	Elijah F. Parker,	ib.
206.	—— Cable Stoppers,	Jesse Reed,	ib.
207.	—— Force Pump,	Henry Rogers,	ib.
208.	—— Harvest Cutters,	David Russel,	ib.
209.	—— Portable Fire Arms,	Alexander O. H. P. Schorn,	ib.
210.	—— Working Franklinite Ore,	Thaddeus Selleck,	ib.
211.	—— Carriage Wheels,	John Skelley,	ib.
212.	—— Straw Cutters,	G. L. Squier,	ib.
213.	—— Cultivator Teeth,	Joseph Stockdale,	ib.
214.	—— Furnaces for Zinc,	Jonathan G. Trotter,	ib.
215.	—— Making India Rubber Cloth,	H. G. Tyer & John Helm,	237
216.	—— Cylindrical Boxes,	Elisha Waters,	ib.
217.	—— Sewing Machines,	Salem Wilder,	ib.
218.	—— Sawing Machines,	Pinney Young,	ib.
219.	—— Spurs,	James S. Ewbank,	ib.
220.	—— Grain Harvesters,	E. A. Morrison, ass'd to self & R. J. Morrison,	ib.
221.	—— Window Washer,	George A. Meacham,	ib.

RE-ISSUES.

1.	Improvement in Mowing Machines and Harvesters,	John H. Manny,	237
2.	—— Harvesters,	John H. Manny,	238
3.	—— Do.		
4.	—— Do.		
5.	—— Do.		
6.	—— Do.		
7.	—— Do.		
8.	—— Spark Arresters,	J. Radley & J. W. Hunter,	239
9.	—— Ploughs,	Cornelius R. Brinckerhoff,	ib.
10.	—— Fastening Lanterns,	C. Monnin & Wm. M. Booth,	ib.

DESIGNS.

1.	For Parlor Stoves,	J. Wager, V. Richmond, & H. Smith,	239
2.	—— Cooking Stove,	G. Smith, H. Brown & J. A. Reed, ass'd to Abbott & Lawrence,	ib.
3.	—— Parlor Cook Stove,		
4.	—— Stoves,		
5.	—— Lanterns,	William D. Titus,	ib.
6.	—— Metallic Coffins,	M. H. Crane, ass'd to Crane, Reed & Co.,	ib.
7.	—— Parlor Open Front Stoves,	N. S. Vedder & E. Ripley, ass'd to G. F. Filley,	ib.
8.	—— Parlor Stoves,		
9.	—— Coal Stoves,	C. Harris & P. W. Zoiner,	ib.

February, 1855.

1.	Improvement in Smut Machine,	J. Bean & B. Wright,	240
2.	—— Double Acting Force Pumps,	W. C. & J. S. Burnham,	ib.
3.	—— Seamless Felt Goods,	John H. Bloodgood,	ib.
4.	—— Daguerreotype Plate Holder,	D. N. B. Coffin, Jr.,	ib.
5.	—— Jack for Moving Railroad Cars,	N. B. Carpenter & J. Powers,	ib.
6.	—— Current Water Wheel,	Richard Deering, Sr.,	ib.
7.	—— Axle Box Rollers,	G. W. & J. C. Geisendorff,	ib.
8.	—— Corn and Cob Crusher,	John S. Griffith,	ib.
9.	—— Wire Cloth Flour Bolt,	F. B. Hunt & E. Nordyke,	ib.
10.	—— Elliptical Rotary Pumps,	B. Holly,	ib.
11.	—— Burglar's Alarm,	David Haldeman,	ib.
12.	—— Repairing Roads,	A. Kimball,	241
13.	—— Pressing Hats and Bonnets,	S. E. Pettee,	ib.
14.	—— Street Sweeping Machine,	R. A. Smith & J. Hartman,	ib.
15.	—— Steam Generators,	William M. Storm,	ib.
16.	—— Crushing and Grinding Mill,	Joel Weigle,	ib.
17.	—— Children's Chair and Crib,	William B. Carpenter,	ib.
18.	—— Locomotive Trucks,	John Cochrane,	ib.
19.	—— Constructing Ships, &c.,	V. P. Corbett,	ib.

20. Improvement in Steam Boilers,	Thomas Champion,	241
21. —— Manufacture of Paper Pulp,	H. Glynna,	242
22. —— Piano Fortes,	J. A. Gray,	ib.
23. —— Grass Harvesters,	J. H. Maydole & A. W. Morse,	ib.
24. —— Sewing Machines,	Isaac M. Singer,	ib.
25. —— Mop Heads,	James A. Taylor,	ib.
26. —— Butter Workers,	J. M. Williams,	ib.
27. —— Grain and Grass Harvesters,	Cyrenus Wheeler, Jr.,	ib.
28. —— Bleaching & Stuffing Leather, 29. —— Liming Vats in Tanneries,	L. W. Fiske,	ib.
30. —— Churns,	Hazen Webster,	ib.
31. —— Retaining Cars on Tracks,	George P. Ketcham,	ib.
32. —— Clover Hullers,	James Allen,	ib.
33. —— Chopping Meat, &c.,	W. H. Allen,	243
34. —— Hop Frames,	Thomas D. Aylsworth,	ib.
35. —— Life Boats,	Hiram Berdan,	ib.
36. —— Cotton Gins,	Henry Clark,	ib.
37. —— Churns,	Edwin B. Clement,	ib.
38. —— Grain Threshers and Cleaners,	George Daniels,	ib.
39. —— Stays for Dresses,	John Dick,	ib.
40. —— Wharf Boats,	Henry T. Dexter,	ib.
41. —— Ploughs,	George Esterly,	ib.
42. —— Smoke Consuming Stove,	J. Esterly,	ib.
43. —— Cracker Machines,	Phineas Emmons,	ib.
44. —— Spirit Levels,	Hampton W. Evans,	ib.
45. —— Steam Boiler Chimneys,	Asahel Fairchild,	244
46. —— Felting Hat Bodies,	William Fuzzard,	ib.
47. —— Rotary Ploughs,	J. W. Haggard & G. Bull,	ib.
48. —— Weather Strips for Doors,	A. Hitchcock,	ib.
49. —— Sewing Machines,	G. H. & B. H. Horn,	ib.
50. —— Ships' Standing Rigging,	Frederick Howes,	ib.
51. —— Teaching Penmanship,	Wm. S. McLaurin,	ib.
52. —— Splitting Leather,	M. H. Merriam & J. B. Crosby,	ib
53. —— Grass Harvesters,	R. J. Morrison, ass'd to self & E. A. Morrison,	ib.
54. —— Lamp Extinguishers,	J. H. Noyes,	ib.
55. —— Slaughtering Hogs,	Jefferson Parker,	245
56. —— Garden Rakes,	S. N. & W. F. Stillman,	ib.
57. —— Bridle Bits,	W. D. Titus & R. W. Fenwick,	ib.
58. —— Ploughs,	Ira Reynolds,	ib.
59. —— Steam Valves,	John Tremper,	ib.
60. —— Railroad Cars,	J. N. Williams,	ib.
61. —— Feeding Paper to Printing Presses,	A. B. Childs & H. W. Dickenson,	ib.
62. —— Sewing Machines,	Edwin A. Forbush,	ib.
63. —— Bank Locks,	Frederick Denzler,	246
64. —— Chimney Safes,	George B. Clark,	ib.
65. —— Life Saving Rafts,	George Blanchard,	ib.
66. —— Metallic Springs,	Levi Bissell,	ib.
67. —— Straw Cutters,	James H. Bennett,	ib.
68. —— Mill Stones for Hulling Rice,	C. R. Barnes,	ib.
69. —— Fluid Burners,	Yarnall Baily,	ib.
70. —— Screw Wrenches,	S. H. Noble,	ib.
71. —— Bullet Mould,	J. S. Keith & John Brooks,	ib.
72. —— Reciprocating Saws,	George P. Ketcham,	247
73. —— Pump Valves,	Gustavus Hammer,	ib.
74. —— Paper from Resinous Barks,	Charles E. Hall,	ib.
75. —— Harrows,	Daniel Haldeman,	ib.
76. —— Cutting Tenons,	J. Hastings, J. Ramsey, & H. G. Chamberlain,	ib.
77. —— Maize Leaf as a Substitute for Tobacco,	J. G. Goshon & S. M. Eby,	ib.

78.	Improvement in Separating Zinc White,	Samuel Wetherill,	247
79.	—— Griddle,	Carington Wilson,	ib.
80.	—— Water Wheel,	Thomas Tripp,	ib.
81.	—— Self-Regulating Water Gates,	George N. Todd,	248
82.	—— Feeding Flour Bolts,	Samuel Taggart,	ib.
83.	—— Slide Rests for Lathes,	William Stephens,	ib.
84.	—— Cutting Wood into Slivers,	S. R. Smith & E. Cowles,	ib.
85.	—— Air Heater,	William Sage,	ib.
86.	—— Skates,	N. C. Sanford,	ib.
87.	—— Skates,		
88.	—— Hand Cultivator,	J. A. Robinson,	ib.
89.	—— Manufacturing Hoops,	Jacob Pierson,	ib.
90.	—— Carriage Windows,	J. T. Ogden, ass'd to self, & T. Goddard,	249
91.	—— Paint Mill,	C. W. Brown, ass'd to G. W. Banker and G. O. Carpenter,	ib.
92.	—— Piano Forte Frames,	Henry S. Ackerly,	ib.
93.	—— Hotel Annunciators,	John Bale,	ib.
94.	—— Gas Cooking Stoves,	James B. Blake,	ib.
95.	—— Anchor Tripper,	Samuel R. Bryant,	ib.
96.	—— Raising Sunken Vessels,	H. V. Corbett,	ib.
97.	—— Boring Machines,	William B. Emery,	ib.
98.	—— Planing Machines,		
99.	—— Making Chain Links,	Ammi M. George,	ib.
100.	—— Repeating Fire Arms,	Daniel B. Neal,	250
101.	—— Fire Engine,	Amos Nudd,	ib.
102.	—— Paper Making,	Obadiah Marland,	ib.
103.	—— Making Butt Hinges,	Charles Miller,	ib.
104.	—— Shecoring Leather Straps,	Charles Morris,	ib.
105.	—— Constructing Vessels,	Z. Pangborn,	ib.
106.	—— Propellers,	Franklin Peale,	251
107.	—— Seed Planters,	R. Romaine,	ib.
108.	—— Hot Air Furnaces,	George S. G. Spence,	ib.
109.	—— Tenoning Machine,	William Steele,	ib.
110.	—— Bed Boat or Life Preserver,	Joseph Stevenson,	ib.
111.	—— Stereoscope Case,	John Stull,	ib.
112.	—— Cutting Barrel Heads,	William L. Young,	ib.
113.	—— Forks for Gold Diggers,	L. Teese & Son,	ib.
114.	—— Corn Shellers,	J. P. Smith,	ib.
115.	—— Holding Carriage Hubs, &c.,	Hiram Hawley,	252
116.	—— Hemp Brakes,	D. W. Hughes,	ib.
117.	—— Looms,	W. V. Gee, ass'd to A. & B. Manuf'g Co.,	ib.
118.	—— Pumping Water from Vessels,	Alexander Kirkwood,	ib.
119.	—— Spoke Machine,	A. Landphere, and S. Rennington,	ib.
120.	—— Paddle Wheels,	Peter Lear,	ib.
121.	—— Grain Mills,	C. Leavitt,	ib.
122.	—— Hulling, &c., Clover Seed,	Martin H. Mansfield,	ib.
123.	—— Mowing Machines,	Fisk Russel,	ib.
124.	—— Screw Jacks,	Thomas C. Ball,	ib.
125	—— Seed Planters,	Andrew J. Barnhart,	253
126.	—— Spade Ploughs,	David Russell,	ib.
127.	—— Covering Thread with Wool or Silk,	John and James Haslem,	ib.
128.	—— Hand Stamp,	D. W. Messer, ass'd to self, Fitts & James,	ib.
129.	—— Carding Machines,	H. N. Gambrill and S. F. Burgee,	ib.
130.	—— Fire Arms,	J. Hollingsworth and R. S. Mershon,	ib.
131.	—— Repeating Fire Arms,		

ADDITIONAL IMPROVEMENT.

1.	Improvement in Seed Planters,	J. Graham Macfarlane,	254

RE-ISSUES.

1.	Improvement in Furnace, &c., for Agriculturists, &c.,	Jordon L. Mott,	254
2.	—— Candlesticks,	J. A. Rockwell, ass'd to F. A. Rockwell,	ib.

DESIGNS.

1. For Stoves,	S. W. Gibbs, ass'd to North, Chase & North,	254
2. —— Cooking Stoves,		
3. —— Daguerreotype Cases,	H. A. Eickmyer,	ib.
4. —— Stoves,	J. Haufbaner and H. Waas,	ib.

March, 1855.

1. Improvement in Cleaning Sisal Hemp,	George D. Allen,	310
2. —— Life Boats,	John Allen,	ib.
3. —— Cook Stoves,	J. J. Anderson,	ib.
4. —— Wagon Springs,	Harman W. Ballard,	ib.
5. —— Guards for Door Locks,	W. Ballauf and F. Wurth,	ib.
6. —— Catch for Breast Pins,	E. C. Benyaurd,	ib.
7. —— Hand Cultivator,	N. B. Chase and C. W. Saunders,	ib.
8. —— Making Bread,	Charles Crum,	ib.
9. —— Fish for Manure and Oil,	R. C. Demolon & G. A. C. Thurneyssen,	311
10. —— Harness Saddle Trees,	J. C. Dickey,	ib.
11. —— Cutting Mitres, &c,	F. A. Gleason,	ib.
12. —— Hydraulic Steam Pump,	R. B. Gorsuch,	ib.
13. —— Auger Handle Fastenings,	G. H. Hubbard,	ib.
14. —— Soda Water Apparatus,	M. F. Hyde,	ib.
15. —— Coal Screen,	George Martz,	ib.
16. —— Grinding and Bolting Sumac,	Samuel W. Powell,	ib.
17. —— Steering Apparatus,	Jesse Reed,	ib.
18. —— Soda Fountains,	Newton D. Robins,	ib.
19. —— Coupling Railroad Cars,	E. Rice,	ib.
20. —— Fire Place,	J. W. Smith and J. S. Gallaher, Jr.,	312
21. —— Making Candles,	J. Stainthorp,	ib.
22. —— Saw Plates and Teeth,	Linus Stuart,	ib.
23. —— Stuffing Horse Collars,	W. L. Whittaker,	ib.
24. —— Locomotive Engine,	John Williams,	ib.
25. —— Extracting Stumps,	W. W. Willis,	ib.
26. —— Arranging School Desks,	V. Woodcock,	ib.
27. —— Illuminating Gas,	D.H.Chamberlain, as'd to H.Woodward,	ib.
28. —— Grain and Grass Harvesters,	J. H. Manny and H. Marcellus,	ib.
29. —— Sash Fasteners,	W. E. Arnold,	313
30. —— Bottle Stopper Fastenings,	T. A. Ashburner,	ib.
31. —— Watch Makers' Lathes,	J. M. Bottum,	ib.
32. —— Turning, Boring, &c., Metals,	Alanson Brown,	ib.
33. —— Self-Loading Carts,	Ze Butt,	ib.
34. —— Excluding Dirt from Grooved Railroad Rails,	C. M. Eakin,	ib.
35. —— Hoop Jacks for Sailing Vessels,	E. Foster,	ib.
36. —— Valves for Steam Engines,	Noble T. Greene,	ib.
37. —— Seed Planters,	H. Ludington and S. R. Lupton,	ib.
38. —— Gas Regulators,	J. W. Hoard,	314
39. —— Screw Wrenches,	Joseph Hyde,	ib.
40. —— Paper Boxes,	Louis Koch,	ib.
41. —— Grain Cleaner,	George Leach,	ib.
42. —— Sleighs,	William W. Gruivits,	ib.
43. —— Ditching Machine,	Robert C. Mauk,	ib.
44. —— Valves for Gas Burners,	Andrew Mayer,	ib.
45. —— Evaporating Apparatus,	James McCracken,	ib.
46. —— Operating Pumps by Wind,	H. Moore,	ib.
47. —— Washing Machines,	Elijah Morgan,	ib.
48. —— Extinguishing Fires,	Edward F. Overdeer,	315
49. —— Lamps,	Frederick C. Rider,	ib.
50. —— Brick Kilns,	Jesse Russell,	ib.
51. —— Ordnance,	Christopher Wolter,	ib.
52. —— Safety Ferry Bridge,	Henry Lawrence,	ib.
53. —— Curtain Rollers,	Frederick W. Urann,	ib.
54. —— Stump Machines,	Edward Vaughn,	ib.
55. —— Door Locks,	William Warwick,	ib.

56.	Improvement in Gutters of Houses,	George W. Wheatly,	316
57.	—— Breech Loading Fire Arms,	R. White,	ib.
58.	—— Breech Loading Fire Arms,		
59.	—— Curing Meats,	J. C. Schooley,	ib.
60.	—— Making Stone Paste Board,	James Smith,	ib.
61.	—— Spinning Wool,	Frederick S. Stoddart,	ib.
62.	—— Air Heating Furnaces,	James H. Sutton,	ib.
63.	—— Operating Ventilators,	Isaac P. Trimble,	ib.
64.	—— Benzole Vapor Apparatus,	C. Cunningham, ass'd to J. C. Pedrick,	ib.
65.	—— Cultivator,	S. A. Knox, ass'd to Ruggles, Nourse & Co.,	317
66.	—— Folding Life Boats,	Edward L. Berthon,	ib.
67.	—— Watch Chain Swivels,	Elihu Bliss,	ib.
68.	—— Wagon Brake,	J. E. Blodget	ib.
69.	—— Knobs for Curtains, &c.,	W. Z. W., and J. W. Chapman,	ib.
70.	—— Ventilating Railroad Cars,	V. P. Corbett,	ib.
71.	—— Air Chamber Pumps,	John P. Cowing,	ib.
72.	—— Cutting Barrel Heads,	A. H. Crozier,	ib.
73.	—— Pumps,	Charles G. Curtis,	318
74.	—— Shot Cartridge,	Abbot R. Davis,	ib.
75.	—— Feeding Fuel to Furnaces,	H. Delano,	ib.
76.	—— Rakes and Elevators,	A. H. Gaston and Joseph Smith,	ib.
77.	—— Extension Tables,	Joel Haines,	ib.
78.	—— Hydraulic Rams,	Thomas Hanson,	ib.
79.	—— Lamps,	Elbridge Harris,	ib.
80.	—— Ship Augers, &c.,	Isaac W. Hoagland,	ib.
81.	—— Railroad Car Brakes,	Gideon Hotchkiss,	ib.
82.	—— Hand Printing Press,	Charles Keniston,	ib.
83.	—— Seed Planters,	Ebenezer Morse,	319
84.	—— Fire Arms,	Frederick Newbury,	ib.
85.	—— Cartridges,	Abner N. Newton,	ib.
86.	—— Seed Planters,	Daniel H. Phillips,	ib.
87.	—— Manufacture of Bricks,	L. E. Ransom,	ib.
88.	—— Mowing Machines,	Fisk Russell,	ib.
89.	—— Daguerreotype Plates,	D. Shive,	ib.
90.	—— Seed Planters,	Benjamin M. Snell,	ib.
91.	—— Self-Loading Cart,	J. A. Sprague and B. O'Conner,	320
92.	—— Mortising and Tenoning,	Elihu Street,	ib.
93.	—— Steam Engines,	H. Uhry and H. A. Luttgens,	ib.
94.	—— Looms,	Lewis Van Riper,	ib.
95.	—— Pumps,	William T. Vose,	ib.
96.	—— Breech Loading Fire Arms,	Alexander T. Watson,	ib.
97.	—— Printing Press,	Lemuel T. Wells,	321
98.	—— Centrifugal Water Wheels,	Oscar Willis,	ib.
99.	—— Grain and Grass Harvesters,	Walter A. Wood,	ib.
100.	—— Cultivators,	George W. N. Yost,	ib.
101.	—— Wheels, Axles, and Friction Rollers,	George A. Prentiss,	ib.
102.	—— Sewing Machines,	George W. Stedman,	ib.
103.	—— Hollow Projectiles,	William M. B. Hartly,	ib.
104.	—— Attaching Augers to Handles,	Charles W. Cotton,	ib.
105.	—— Ore Separators,	Reuben Shaler,	ib.
106.	—— Sewing Machines,	T. J. W. Robertson, ass'd to self and E. A. Beach,	322
107.	—— Casters for Furniture,	G. L. Bailey, ass'd to self and M. Nutting,	ib.
108.	—— Rotary Pump,	Abel Barker,	ib.
109.	—— Lumber Jointing,	Charles F. Bauersfeld,	ib.
110.	—— Preparing Woolen Roving,	Augustus E. Bigelow,	ib.
111.	—— Spinning Wool,		
112.	—— Turning Lips of Augers,	Ransom Cook,	ib.
113.	—— Grain and Grass Harvesters,	A. Dietz and J. G. Dunham,	ib.
114.	—— Refining Jewelers' Scraps,	L. B. Darling,	ib.
115.	—— Governors,	William H. Elliot,	323

116. Improvement in Chairs,	Lemuel W. Ferris,	323
117. —— Supporting Table Leaves,	Henry A. Frost,	ib.
118. —— Cultivators,	Henry D. Ganse,	ib.
119. —— Screw Wrenches,	L. D. Gilman,	ib.
120. —— Packing Journal Boxes,	Warner Grout,	ib.
121. —— Steam Engines,	W. H. Guild and W. F. Garrison,	ib.
122. —— Looms,	David S. Harris,	ib.
123. —— Fire Proof Safes,	R. G. Holmes and W. H. Butler,	ib.
124. —— Vault Covers,	T. Hyatt,	ib.
125. —— Looms,	William S. Irish,	324
126. —— Grate Bars,	J. S. Kirk and W. H. Elliot,	ib.
127. —— Boring Hubs for Boxes,	U. Kimble,	ib.
128. —— Chalking Lines,	S. B. Knight,	ib.
129. —— Shingle Machines,	Charles Leavitt,	ib.
130. —— Self Adjusting Pump,	Thomas Ling,	ib.
131. —— Charcoal Furnaces,	John McNeill,	ib.
132. —— Seed Planters,	Hiram Moore,	ib.
133. —— Bill Holder,	George W. Palmer,	ib.
134. —— Coffins,	David Sholl,	ib.
135. —— Current Wheel,	William S. Smith,	325
136. —— Making Boots and Shoes,	H. G. Tyer and J. Helm,	ib.
137. —— Seed Planters,	Myron Ward,	ib.
138. —— Cultivators,	R. P. Vanhorn,	ib.
139. —— Pulling Cotton Seeds,	Joseph Walker,	ib.
140. —— Cultivators,	William P. Zane,	ib.
141. —— Making Kerosene,	A. Gesner, ass'd to the Asphalte M. & K. Gas Co.,	ib.
142. —— Manufacture of Zinc White,	S. Gardiner, ass'd to E. Kellog,	ib.

ADDITIONAL IMPROVEMENT.

1. Improvement in Lubricators,	Robert M. Wade,	325

RE-ISSUES.

1. Improvement in Grain and Grass Harvesters,	John H. Manny,	326
2. —— Grain and Grass Harvesters,		
3. —— Grain and Grass Harvesters,		
4. —— Metallic Coffins,	M. H. Crane, ass'd to Crane, Breed & Co.,	ib.
5. —— Separating Flour from Bran,	I. Frost and J. Monroe,	ib.

DESIGNS.

1. For Table Forks,	J. W. Gardner,	326
2. —— Cooking Stoves,	J. Beesely and E. J. Delany,	ib.

April, 1855.

1. Improvement in Factitious Oils,	Henry W. Adams,	326
2. —— Presses,	James P. Arnold,	ib.
3. —— Manufacture of White Lead,	Richard Baker,	327
4. —— Lubricating Air Pumps,	Abel Barker,	ib.
5. —— Seed Planters,	C. B. and B. S. Borden and A. R. McLean,	ib.
6. —— Steam Engines,	Louis Bollman,	ib.
7. —— Ships' Riding Bitts,	Thomas Brown,	ib.
8. —— Paddle Wheels,	Levi M. Dehart,	ib.
9. —— Anchors,	Richard V. Guinow,	ib.
10. —— Coal Holes,	Samuel W. Frost,	ib.
11. —— Valves for Steam Engines,	Thomas Goodrum,	ib.
12. —— Hydraulic Steam Pumps,	Robert B. Gorsuch,	328
13. —— Hose Coupling,	Smith Groom,	ib.
14. —— Ploughs,	Thomas J. Hall,	ib.
15. —— Wind Musical Instruments,	G. Hammer,	ib.
16. —— Loading Rifled Cannons,	L. Houghton,	ib.
17. —— Looms,	Barton H. Jenks,	ib.
18. —— Double Acting Force Pump,	Benjamin F. Joslin,	ib.
19. —— Rakes and Hay Elevators,	W. J. Keeney and J. R. Tarbox,	ib.
20. —— Dumping, &c., Coal Cars,	George Martz,	ib.
21. —— Hand Printing Presses,	E. Mathers and W. D. Siegfried,	329

22.	Improvement in Cotton Gins,	James B. Mell,	329
23.	—— Lancets,	Henry Mellish,	ib.
24.	—— Coal Hole Covers,	F. H. Moore,	ib.
25.	—— Breech Loading Fire Arms,	R. White,	ib.
26.	—— Stove Pipe Tube,	Thomas Moore,	ib.
27.	—— Dumb Waiters,	Andrew Murtaugh,	ib.
28.	—— Seed Planters,	Ives W. McGaffey,	ib.
29.	—— Fire Proof Floor and Ceiling,	F. A. Peterson,	ib.
30.	—— Fire Escape Ladder,	Stephen R Roscoe,	ib.
31.	—— Railroad Car Seats,	Alpheus D. Smith,	ib.
32.	—— Chain Pumps,	Arcalous Wyckoff,	ib.
33.	—— Lamp Shade Protector,	C. and A. Wilhelm,	330
34.	—— Bank Locks,	C. Gustav Mueller,	ib.
35.	—— Reciprocating Fire Arms,	Rollin White,	ib.
36.	—— Reciprocating Fire Arms,		
37.	—— Ploughs,	Noah Warlick,	ib.
38.	—— Excavating Machine,	C. Williams,	331
39.	—— Opening and Closing Gates,	Enos Woodruff,	ib.
40.	—— Cultivators,	Francis L. Smithson,	ib.
41.	—— Freeing Steam Boilers from Sediments,	Hiram Strait,	ib.
42.	—— Breech Loading Fire Arms,	G. H. Soule,	ib.
43.	—— Folding Bedsteads,	William Stoddard,	ib.
44.	—— Grain Cleaner,	Benjamin T. Trimmer,	ib.
45.	—— Washing Machines,	G. W. Edgecomb,	ib.
46.	—— Harrows,	C. Clareni, ass'd to self and G. P. Field,	ib.
47.	—— Dirt Scrapers for Boots and Shoes,	O. A. Crane and H. J. Lewis,	ib.
48.	—— Curtain Roller Fixtures,	J. Hartshorne and D. H. Chamberlain,	ib.
49.	—— Lathe,	Warren Aldrich,	370
50.	—— Drills for Artesian Wells,	J. Andrews,	ib.
51.	—— Saw Teeth,	Nelson Barlow,	ib.
52.	—— Steam Boilers,	Horace Boardman,	ib.
53.	—— Raising and Transporting Stone,	Solomon E. Boiles,	ib.
54.	—— Rotary Harrows,	L. Brainard, and L. Newton,	ib.
55.	—— Winding up Lines, &c.,	B. Boardman and G. C. Sweet,	371
56.	—— Ornamenting Metal Tubes,	S. M. Cate and E. Jordan,	ib.
57.	—— Boot Forms,	J. Chilcot and R. Snell,	ib.
58.	—— Recording Votes,	Thomas C. Connolly,	ib.
59.	—— Seed Planters,	Jason W. Corey,	ib.
60.	—— Locomotive Boilers,	Josiah J. Dutcher,	ib.
61.	—— Card Exhibitor,	Wright Duryea,	372
62.	—— Portable Door Fasteners,	Benjamin R. Eames,	ib.
63.	—— Building Concrete Walls,	Salathiel Ellis,	ib.
64.	—— Boring Hubs,	H. C. Garvin and J. H. King,	ib.
65.	—— Burning Wet Fuel,	Moses Thompson,	ib.
66.	—— Reciprocating Saws,	C. B. Hutchinson,	ib.
67.	—— Railroad Car Coupling,	James H. Jones,	ib.
68.	—— Fire Arms,	Ferdinand Klein,	ib.
69.	—— Steam Generators,	Alexander B. Latta,	ib.
70.	—— Straw Cutters,	Walter Lackey,	373
71.	—— Replacing Railroad Cars on the Track,	Robert F. R. Lewis,	ib.
72.	—— Tension Bars of Car Brakes,	W. Loughridge,	ib.
73.	—— Engine for Extinguishing Fires,		
74.	—— Boring Wells,	John F. Manahan,	ib.
75.	—— Pairing Apples,	Samuel N. Maxam,	374
76.	—— Cultivators,	A. H. Morrel,	ib.
77.	—— Mortising Blinds,	Benjamin J. Norris,	ib.
78.	—— Gas Regulator,	Samuel P. Parham,	ib.
79.	—— Beadstead Fastenings,	Joseph Rodefer,	ib.
80.	—— Straw Cutters,	Ira Rose,	ib.
81.	—— Venetian Window Blinds,	Charles Rose,	ib.

82.	Improvement in Straw Cutters,	David Russell,	374
83.	—— Straw Cutters,	Samuel J. Sharp,	ib.
84.	—— Platform Balances,	David M. Smyth,	ib.
85.	—— Straw Cutters,	T. C. Simonton and Loren J. Wicks,	ib.
86.	—— Plate Holders for Cameras,	Albert S. Southworth,	375
87.	—— Friction Rollers,	John and Thomas Sweeney,	ib.
88.	—— Feeding paper to Printing Presses,	J. B. Hall,	ib.
89.	—— Cabin Chairs,	William Thomas,	ib.
90.	—— Railway Splice Pieces,	Isaac R. Trimble,	ib.
91.	—— Circular Saw Spindles,	Hiram Wells,	ib.
92.	—— Boring the Earth,	C. N. White,	ib.
93.	—— Paint Mill,	D. E. Paynter, ass'd to I. M. Bissell,	ib.
94.	—— Turning Locomotive Drivers,	J. M. Stone, ass'd to Man. Loco. Works,	376
95.	—— Bleaching Apparatus,	C. F. Appleton,	ib.
96.	—— Sash Fasteners,	William E. Arnold,	ib.
97.	—— Constructing Gas Retorts,	Henry P. M. Birkinbine,	ib.
98.	—— Punching Metals,	M. Burnett and C. Vander Woerd,	ib.
99.	—— Melodeons,	Jeremiah Carhart,	ib.
100.	—— Grain and Grass Harvesters,	J. Case,	ib.
101.	—— Explosive Gas Engine,	Alfred Drake,	ib.
102.	—— Lubricating Compounds,	N. Dresser,	ib.
103.	—— Gas Generating in Parlor Stoves,	Solomon B. Ellithorp,	ib.
104.	—— Ships' Windlasses,	James Emerson,	ib.
105.	—— Melting Sugar,	Conrad William Finzel,	377
106.	—— Dredging Machines,	Charles H. Fondé,	ib.
107.	—— Grain and Grass Harvesters,	Eliakim B. Forbush,	ib.
108.	—— Casting Pencil Sharpeners,	W. K. Foster,	ib.
109.	—— Piercing Metals,	DeGrasse, and George Fowler,	ib.
110.	—— Turning Leaves of Music Books,	Isaac Gallup,	ib.
111.	—— Stud and Button Fasteners,	S. W. Hopkins, as'd to Green, Mauran and Jackson,	ib.
112.	—— Rotary Engines,	Abraham Masson,	ib.
113.	—— Fountain Pen,	Hugh R. McClelland,	ib.
114.	—— Hay Making Machine,	Francis Peabody,	378
115.	—— Shut-off Valve Gear,	John B. Schenck,	ib.
116.	—— Horse Power,	John Simpson,	ib.
117.	—— Compensating Bearings,	Lewis Smith,	ib.
118.	—— Making Printers' Ink,	C. A. Thompson,	ib.
119.	—— Pen Holder,	William H. Towers,	ib.
120.	—— Dies for Bolt Forging,	John J. Willmarth,	ib.
121.	—— Paper Ruling Machine,	T. J. Baldwin,	ib.
122.	—— Piano Forte Action,	Stephen P. Brooks,	ib.
123.	—— India Rubber Springs,	William F. Converse,	379
124.	—— Making Metal Tubes,	Martin R. Griswold,	ib.
125.	—— Hay Press,	Pells Manny,	ib.
126.	—— Gas Cooking Stove,	Andrew Mayer,	ib.
127.	—— Slide Rest for Lathes,	C. A. Noyes,	ib.
128.	—— Life Preserving Doors,	J. T. Pheatt,	ib.
129.	—— Cultivators,	John Stryker,	ib.
130.	—— Grain and Grass Harvesters,	Phylo Sylla,	ib.
131.	—— Rotary Engines,	John J. Thomas,	ib.
132.	—— Slide Rest for Lathes,	Chester Van Horn,	ib.
133.	—— Metallic Hones,	Willam H. Webb, Jr.,	380
134.	—— Locomotive Furnace,	O.W. Bayley, as'd to Man. Loco. Works,	ib.
135.	—— Rakes,	H. Chalfield, ass'd to self and T. L. Snyder,	ib.
136.	—— Folding Carriage Tops,	W. G. Fogglesong, ass'd to self, and B. D. Anderson,	ib.
137.	—— Propellers,	W. D. Jones, ass'd to Henry Whinfield,	ib.
138.	—— Elastic Tube Pump,	R. Porter and J. D. Bradley, ass'd to J. D. Bradley and G. Dennison,	ib.
139.	—— Sewing Machines,	E. H. Smith, ass'd to Wheeler and Wilson Manufacturing Co.	ib.

140. Improvement in Cast Iron Pavements,	G. Neilson, ass'd to self and N. Hunt,	380
141. —— Grain and Grass Harvesters,	Jearum Atkins,	ib.
142. —— Washing Machines,	Jason W. Corey,	381
143. —— Stoves, &c.,	J. Johnson and J. E. Crane,	ib.
144. —— Manufacture of Slate Pencils,	Norman C. Harris,	ib.
145. —— Shearing Sheep,	Palmer Lancaster,	ib.
146. —— Feeding paper to Printing Presses,	I. B. Livingston and M. Waterhouse,	ib.
147. —— Looms,	J. G. Mellville and W. Brayshaw,	ib.
148. —— Piano Forte Action,	William Munroe,	ib.
149. —— Carriage Springs,	Thomas Murgatroyd, Jr.,	ib.
150. —— Combined Table and Writing Desk,	Lucius Page,	ib.
151. —— Polishing Stone,	Louis S. Robbins,	382
152. —— Planing Metals,	James H. Thompson,	ib.
153. —— Attaching Wheels to Harvesters, &c.,	Abner Whiteley,	ib.
154. —— Harvesters,		
155. —— Forge Hammer,	J. Comstock, ass'd to P. Naylor,	ib.
156. —— Dressing Lawns,	R. L. Hawes, ass'd to R. Rennie	ib.

ADDITIONAL IMPROVEMENTS.

1. Improvement in Pen Holders,	E. W. Hanson,	383
2. —— Saddle Trees,	William E. Jones,	ib.

RE-ISSUES.

1. Improvement in Vault Covers,	Thaddeus Hyatt,	383
2. —— Grain and Grass Harvesters,	Abner Whitely,	ib.
3. —— Grain Harvesters,	A. Palmer and S. G. Williams,	ib.
4. —— Winnowing Machines,	Benjamin D. Sanders,	ib.
5. —— Hinge of Rolling Iron Shutters,	A. Livingston Johnson,	384
6. —— Moulds for Pressing Glass,	Hiram Dillaway,	ib.

DESIGNS.

1. For Handles of Forks and Spoons,	H. Biggins, ass'd to M. Gibney,	384
2. —— Spoons,	John Graham,	ib.
3. —— Clock Fronts,	William B. Lorton,	ib.
4. —— Cooking Stoves,	G. Warren, S. H. Sweetland, and E. C. Little,	ib.
5. —— Water Coolers,	G. Smith, H. Brown and J. A. Reed, ass'd to Abbott & Lawrence,	ib.

Agriculture and Geology of Mississippi—Notice of Report on the 215
Air and the Ground under Snow, and that from which the Snow has been removed —Notes of Difference of Temperature between the 270
——Engine—On the Means of Realizing the advantages of the 68
Alcohol and Wood Spirit—Relative Fuel Value of 209
——— from Vegetable Fabres, especially from Wood—Mode of Producing 258
Aluminous and Iron Mordants—On Silicate of Soda as a Means of Fixing 411
Ariel—Particulars of the Steamer 285
Astoria—Particulars of the Steamer 410

Bakers' Bread—Chemical Examination of 386
Bakewell, (T. W.)—On the Circumference of the Ellipse, 369
Betons not attacked by Sea Water—Composition of 231

BIBLIOGRAPHICAL NOTICES.

Discoveries in Chinese—or the Symbolism of the primitive Characters of the Chinese System of Writing, 144
De Bow's Industrial Review, ib.
Report on the Agriculture and Geology of Mississippi, 216
Outlines of Medical Chemistry—for the use of Students, 360
Lowell Hydraulic Experiments on Flow of Water over Weirs and in Canals, 420
The Quarterly Journal of Pure and Applied Mathematics, ib.

Blast Furnaces—On the use of Caustic Lime in . . . 89
Boilers and Causes of Explosions—On the Strength of Locomotive 179
Brakes for Railroad Cars—Notice and Description of McLaughlin's . 72, 217
Brass by Galvanic Agency—On the Formation of . . 354
Bridge—Report on Bollman's Iron Suspension Railroad . . 289
Bridges—A New Method of Proportioning Stone . . 14
Buffalo Water Works—Performance of the Cornish Pumping Engine of the 271
Buildings by Hydraulic Pressure—Lifting Brick . . 270

Camera—On taking Daguerreotypes without a . 344, 416
Canals—Notice of the Lowell Hydraulic Experiments on the Flow of Water over Weirs and in 420
Candles, Soap, and Glycerine—On the Manufacture of . 36
Cartwright, (H)—On Performance of the Cornish Pumping Engines of the Buffalo Water Works, ... 271
Cements, Mortars, and Puzzolanos—On the Destructive Action of Sea Water on Hydraulic 13
Chemistry for use of Students—Notice of Rand's Outlines of Medical 360
Chesapeake and Delaware Canal Company—General Report of the . 163
Chinese System of Writing—Notice of Discoveries in Chinese or the Symbolism of the Primitive Characters of the . . . 144
Coal—Description of a Machine for Washing . . 70
——— **Gas**—On the Purification of . . . 198
———, Manufacture and Application of Various Products obtained from 277, 332
Coffer Dams, &c.—Description of Holstrom's Air Lock for Sinking Iron Piles, 138
Commonwealth—Particulars of the Steamboat . . 275
Cornish Pumping Engines of the Buffalo Water Works—Performance of the 271
Cuba—Particulars of the Steamboat . . . 57
Curiosities in Science, . . . 276

Daguerreotypes without a Camera—On taking . 344, 416
DeBow's Review—Industrial Resources, &c.—Notice of . 144
Diamond from Brazil—Description of a New . . 254
Disk Gauge—Description of Beaumont's Hollow Cone . 412

Earth's Mass—Pendulum Test of the . . 207
Electric Induction of Current and Static Effects, . . 402
——— **Properties of the Metals Zinc and Silver**—On some of the Thermo- 352
Ellipse—On the Circumference of the . . . 369
Elm City—Particulars of the Steamboat . . 411
Engineering—On Errors committed by Writers on Mechanical . 145
——— ——— T. Prosser's Reply to the above, . . 304
Engraving Machine—Description of an Electro-Magnetic . 129
Explosion—On Strength of Locomotive Boilers and Causes of . 179
Explosions, and the Explosive Force of Highly Heated Water—On Steam Boiler 338, 396

Falls of Niagara—Passage of the First Locomotive over the Suspension Bridge over the 233
Fatty and Oily Matters applicable to the Manufacture of Soaps, Candles, and Glycerine, ... 36
Fire Engine—Performance of Shawk's Steam . . 414
Fly Wheel—Notice of a Monster . . . 120
Franklin—On the Gold Fish of . . . 407
Fuch's Stereochrome—Description of . . 47
Fuel Value of Alcohol and Wood Spirit—On the relative . 209
Furnace for heating Buildings—Report on Tasker's Self-Regulating Water 418
Furnaces—On the Means of avoiding Smoke from Boiler . 84
——— ——— ——— use of Caustic Lime in Blast . . 89

Franklin Institute.

Proceedings of Monthly Meetings, . 71, 141, 212, 286, 355, 415

FRANKLIN INSTITUTE.

Committee on Science and the Arts.

Report on J. F. Mascher's Stereoscopes, . . . 214
——— J. W. Queen's Microscope for Students, . . . 215
——— A. Mayer's Gas Nipples, . . . 356
——— T. T. Tasker's Self-Regulating Water Furnace for Heating Buildings, ... 417

Galvanic Agency—On the Formation of Brass by . . 354
——— Telegraph—On Transmitting two Messages at the same time in opposite directions on the . . . 351
Galvanometer—Notice of T. J. Weygandt's Improved . 287
Gas and Oil from Vegetable Substances—Process for obtaining . 347
—— from Wood—Notice of Dr. Cresson's Illuminating . 287
—— On the Purification of Coal . . . 198
—— through Pipes—On the Flow of . . 42, 121
—— to the Burners—Description of a Regulator for the Supply of . 130, 133
——, Water, and Steam Pipes—Description of a New Jointing for 409
Gauge—Description of Beaumont's Hollow Cone Disk Pressure . 412
Gelatine Paper as a Medium for Coloring Light—On the Applicability of 351
Geology and Agriculture of Mississippi—Notice of a Report on the . 216
Glycerine, Soap, and Candles—On the Manufacture of . 36
Governor for Marine Steam Engines—Notice of Silver's . . 416
Gold Fish of Franklin—On the 407
Great Britain—Particulars of the Mammoth Steamer . . 56
Ground under Snow and that from which the Snow has been removed—Notes on the Difference of Temperature between the Air and the . 270

Haswell (C. H. H.)—Particulars of the Steamers:

Great Britain,	56	Commonwealth,	275
Cuba, . .	57	Ariel, . .	285
Leviathan, . .	57	William Jackson,	286
Joseph Whitney,	136	Astoria, . .	410
Ocean Bird, .	274	Elm City, .	411

Heat—On the Mechanical Equivalent of . . 256
Heating Buildings—Report on Tasker's Self-Regulating Water Furnace for 417
Hoosac Tunnel—Considerations Respecting the . . 11
Howe's Truss—Investigation of the Angle Block of . . 306
Hudson River at Albany—On the Railroad Crossing of the . 232
Hydraulic Experiments on Flow of Water over Weirs and in Canals—Notice of the Lowell 420
Hydraulic Mortars, Cements, and Puzzolanos—On the Destructive Action of Sea Water on 13
——— Pressure—Lifting Brick Buildings by . . 271

Incrustation of Steam Boilers—On the . . . 264
Iron Foot Pavements—Notice of a New Cast . . 88
—— Industry of the United States, . . . 201
—— Mordants—On Silicate of Soda as a means of fixing Aluminous and 411
—— On the Durability of Railroad . . . 148
—— Piles, Coffer Dams, &c.—Description of Holstrom's Air Lock for sinking 138
—— Ships—On the Navigation of . . . 61
—— Suspension Railroad Bridge—Report on Bollman's . . 289
Isherwood (B. F.)—On the Ventilation of the Fire Room of Steamships, 131
——— On the Laws Regulating the Slips of Screw Propellers, 156, 219, 295, 361

Japan Squadron—Performance of the Steamship Susquehanna during her employment in the 259
Japanese Arts and Manufactures—Notice of the . . 143
Jones (W.)—Description of Kensington Water Works, . . 7
Joseph Whitney—Particulars of the Steamer . . 132

Kensington Water Works—Description of the . . 7

Lathe for Turning Cast Iron Pulleys—Notice of Nasmyth's . 72
Leviathan—Particulars of the Steam Tug . . . 57
Light—On the Action of the Violet and Ultra Violet Invisible . 262
——— On the Applicability of Gelatine Paper as a Medium for Coloring 351
Lightning Conductors, . . . 210
Lime in Blast Furnaces—On the use of Caustic . . 89
Lithographic Printing—Photographic Pictures on Stone for . 257
Locomotive Boilers and Causes of Explosion—On the Strength of . 1, 79
———— over the Suspension Bridge over the Falls of Niagara—Passage of the First 233
Locomotives—Notice of Fouser's Apparatus for Removing Wheels from 417

Magnetic Engraving Machine—Description of an Electro- . 129
——— Field—On some Peculiarities of the . . 62
——— Hypothesis, ... 39
——— Needle Peculiar to Liverpool—On the Deviation of the . 67
Mallet—Notice of W. Jones' Improved . . 288
Marine Steam Engines—Notice of Silver's Governor for . . 416
Mascher (J. F.)—On taking Daguerreotypes without a Camera, . 344, 416
Mathematics—Notice of the Quarterly Journal on Pure and Applied 420
Medical Chemistry for Students—Notice of Rand's Outlines of . 360
Metals—Process for Tinning 275
Metallic Packing for Steam Pistons—Notice of Morris, Tasker & Morris' 356
Microscope for Students—Report on J. W. Queen's . . 215
Mints of the United States—Notice of the . . . 49
——— France—Notice of the . . . 139
Mississippi—Notice of the Report on the Agriculture and Geology of 216
Mordants—On Silicate of Soda as a Means of Fixing Aluminous and Iron 411

Naval Architecture and Steam Navigation—On the Progress of . 196
Navigation of Iron Ships, . . . 61
North Carolina—Performance of the Steamship . . 395

Ocean Bird—Particulars of the Steamer . . 274
Ohio and Pennsylvania Railroad Co.—Extracts from the Seventh Annual Report of the 231
Oil and Gas from Vegetable Substances—Process for Obtaining . 347
Oily and Fatty Matters Applicable to Manufacture of Soaps, Candles, and Glycerine, 36
Omnibus Registers—Notice of H. Hochstrasser's Improved . . 288

Pages of Books—Notice of an Improved Machine for Printing . 288
Paper as a Medium for Coloring Light—On the Applicability of Gelatine . 351
——— Imported, Exported, and Used in Great Britain—Statistics of Rags and 406
——— from Pulp made from Bass Wood—Notice of . . 288
——— Notice of the Application of the Thistle to the Manufacture of 413
Pavement—Notice of a New Cast Iron Foot . . 88
Pendulum Test of the Earth's Mass, . . . 207
Photographic Pictures on Stone for Lithographic Printing, . 257
Piles, Coffer Dams, &c.—Description of Air Lock for Sinking Iron . 138
Pipes formed Internally of Porcelain—Description of Water . 210
——— On the flow of Gas through . . . 43, 121
———————— Water through . . . 191, 335
Piston upon a Rod—Description of a Method of Securing a . 140
Pistons—Notice of Morris, Tasker & Morris' Metallic Packing for Steam 356
Pressure Gauge—Description of Beaumont's Hollow Cone Disk . 412
Printing from Nature by Heat—Called Thermography, . . 59
Propeller Shafts—Description of Gearing to Increase the Speed of . 213
Propellers—On the Laws Regulating the Slips on Screw . 156, 219, 295, 361
Propulsion by Screws with the Axis above the Water, . 394
Prosser (T.)—Reply to Truran on Errors committed by Writers on Mechanical Engineering, ... 304

Pumping Engines of the Buffalo Water Works—Performance of the Cornish 271
Puzzolanos, Hydraulic Mortars and Cements—On the Destructive Action of Sea Water on 13

Rags and Paper Imported, Exported and used in Great Britian—Statistics of 406
Railroad Bars—On the Defective Manufacture of . . 73
——— Bridge—Report on Bollman's Iron Suspension . 289
——— Car Brakes—Notice and Description of McLaughlin's . 72, 217
——— Co.—Extract from Seventh Annual Report of the Ohio and Pennsylvania 231
——— Crossing of the Hudson River at Albany—On the . . 232
——— Iron—On the Durability of 148
Railroads—On the Fish Joints in Rails on 294
Railway Signals from China . . . 12
——— Wheels—On the Manufacture of Rails and parts of Railways, and Tyres of 200
Razors—Description of M. Picault's method of making . . 66
Reapers—Notice of J. Atkins' Self-Acting Raker for . 355
Richardson, J. M.—Investigation of the Angle Block of Howe's Truss . 306
Rogers, F.—Notice of a new Cast Iron Foot Pavement . 88
Rifle—Notice of A. D. Perry's patent . . . 417

Salt in the Sea—Object of 384
Sandstone, &c., Impervious to Moisture—Process for rendering . 136
Screw Propellers—On the Law Regulating the Slips of . 156, 219, 295, 361
——————— with the Axis above the Water—On Propulsion by . 364
Sea Water—Composition of Betons not Attacked by . 231
——— on Hydraulic Mortars, Cements, and Puzzolanos—On the Destructive Action of 13
Serrill, E. W.—Considerations respecting the Hoosac Tunnel, . 11
——————— On the Railroad Crossing of the Hudson River at Albany . 232
Sheathing of Ships—On the Composition of . . 48
Ships—On the Navigation of Iron . . . 61
Shoes—Notice of Russian over . . . 213
Signal Trumpet—Description of the Telephone, or Marine Alarm and . 91
Signals from China—Railway . . . 12
Silicate of Soda as a Means of fixing Aluminous and Iron Mordants . 411
Silver—On some of the Thermo-Electric Properties of Zinc and . 352
Smoke from Boiler Furnaces—On means of avoiding . . 84
Soaps, Candles, and Glycerine—Treatment of Fatty and Oily matters in the manufacture of 36
Soil from the Desert of Atacama—Analysis of the Surface . 407
Stand Pipe of the West Philadelphia Water Works—Birkinbine & Trotter's claim to the design of the . . . 210
——————— H. Howson's reply to the above claim . . 266
Steam Boiler Explosions and the Explosive force of Highly Heated Water—On 338, 396
——————— On the Incrustations of . . . 264
—— Engine—Notice of a Pendulum Reciprocating . 71
——————— Notice of Wharton and Shivers' . . 214
—— Engines—Notice of Silver's Governor for Marine . 416
—— Fire Engine—Performance of Shawk's . . 414
—— Navigation—On the Progress of Naval Architecture and . 196
—— Navy of the United States—Notice of the . . 126
—— Pipes—Description of a new Jointing for Gas, Water, and 409
—— Pistons—Notice of Morris, Tasker & Morris' Metallic Packing for 356
—— Ship North Carolina—Performance of the . . 395
—— Ship Susquehanna during her employment in the Japan Squadron—Performance of the U. S. . . . 259
—— Ships—On the Ventilation of the Fire Rooms of . . 131
Steamers—Particulars of the

Great Britain,	56	Commonwealth,	275
Cuba,	57	Ariel,	285
Leviathan,	57	William Jackson,	286
Joseph Whitney,	136	Astoria,	410
Ocean Bird,	274	Elm City,	411